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# TRANSACTIONS

OF THE

# CONGRESS

OF

# American Physicians and Surgeons

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TWELFTH TRIENNIAL SESSION,

HELD AT

WASHINGTON, D. C.

May 2nd and 3rd, 1922.

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# MINUTES.

The twelfth triennial session of the CONGRESS OF AMERICAN PHYSICIANS AND SURGEONS was held in the Hall of Nations of the Washington Hotel, in Washington, D. C., on May 2d and 3d, 1922, according to the programme as ordered by the Executive Committee.

The first session was called to order at 8 P. M., Tuesday, May 2d, by the first Vice-President, Dr. Herbert C. Moffitt of San Francisco. Dr. Frank Billings then delivered his address on "Present Day Problems Which Affect the Medical Profession and the Public."

On the following day the meeting was called to order at 2.30 P. M., by the President, Dr. Frank Billings. The subject to be considered was "Some Aspects of the Physiology and Pathology of Nutrition." Papers were read by Dr. E. V. McCollum of the School of Hygiene and Public Health, Johns Hopkins University, Baltimore, on "Factors Which Enter Into an Adequate Diet"; by Dr. L. B. Mendel of the Sheffield Scientific School, Yale University, New Haven, on "Experimental Evidence of the Lack of Vitamin B in Nutrition"; by Dr. H. C. Sherman of Columbia University, New York, on "The Distribution and Properties of Vitamin C"; by Dr. Paul G. Shipley of Johns Hopkins Medical School, Baltimore, on "The Relation of the Diet to Rickets"; by Dr. Joseph Goldberger of the United States Public Health Service, Washington, on "The Pellagra Problem and Its Relation to Diet," and by Dr. L. Emmett Holt of New York City on "The Bearing of the Newer Findings Upon the Problems of Medical Practice." These papers were discussed by Dr. Alfred F. Hess of New York.

Adjournment.

# BY-LAWS OF THE CONGRESS

OF

# AMERICAN PHYSICIANS AND SURGEONS.

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1.

This organization shall be known as the
CONGRESS OF AMERICAN PHYSICIANS AND SURGEONS.

2.

It shall be composed of national associations for the promotion of medical and allied sciences.

3.

It shall hold its sessions triennially in the city of Washington, D. C.

4.

The officers of the Congress shall be a PRESIDENT, VICE-PRESIDENTS, A SECRETARY, A TREASURER, AND AN EXECUTIVE COMMITTEE.

5.

The PRESIDENT shall be elected by the Executive Committee, of which he shall be *ex-officio* a member. He shall preside at the sessions of the Congress. He shall deliver an address.

6.

The PRESIDENTS of the participating societies shall be *ex-officio* the VICE-PRESIDENTS of the Congress.

7.

The SECRETARY and the TREASURER shall be elected by the Executive Committee. They shall be *ex-officio* members of the Executive Committee.

8.

The EXECUTIVE COMMITTEE shall be composed of one (1) member from each participating Society, and said members shall be elected by the various Societies at the next annual meeting subsequent to the Congress.

It shall be charged with all duties pertaining to the organization of and preparation for the ensuing Congress, including the election of all officers and of a Committee of Arrangements.

It shall superintend the publication of the Transactions of the Congress.

9.

The expenses of the Congress shall be divided between the participating Societies in proportion to their membership.

10.

The admission of new associations to participate in the Congress shall be by unanimous vote of the EXECUTIVE COMMITTEE.

## GUESTS OF THE CONGRESS.

By Invitation of the Executive Committee.

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Surgeon-General Edward R. Stitt, United States Navy.
Surgeon-General Hugh S. Cumming, United States Public Health Service.

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| Dr. Shields Warren, | Brookline, Massachusetts. |
| Dr. John R. Williams, | Rochester, New York. |
| Dr. Sampson J. Wilson, | Brooklyn, New York. |
| Dr. Alfred M. Wise, | Brooklyn, New York. |

## RECAPITULATION.

| | Emeritus, Senior, Active and Associates. | Corresponding. | Honorary. | Present. |
|---|---|---|---|---|
| American Ophthalmological Society ... | 185 | .. | 1 | 97 |
| American Otological Society ..... | 120 | .. | 7 | 65 |
| American Neurological Association ... | 159 | .. | 3 | 95 |
| American Gynecological Society ..... | 93 | .. | 37 | 64 |
| American Dermatological Association. | 82 | 15 | 10 | 55 |
| American Laryngological Association . | 96 | 22 | 7 | 58 |
| American Surgical Association ..... | 183 | .. | 19 | 120 |
| American Climatological and Clinical Association ..... | 164 | 8 | 15 | 95 |
| Association of American Physicians... | 245 | .. | 10 | 143 |
| American Association of Genito-Urinary Surgeons ..... | 77 | 10 | 4 | 46 |
| American Orthopedic Association ..... | 106 | 8 | 8 | 68 |
| American Pediatric Society ..... | 84 | .. | 9 | 56 |
| American Association of Pathologists and Bacteriologists ..... | 343 | .. | .. | .. |
| American Society of Tropical Medicine | 169 | 14 | 18 | .. |
| | 2106 | 77 | 148 | 962 |
| Total membership of Congress ..... | | 2049 | | |
| Guests and Visitors ..... | | | | 53 |
| Total attendance ..... | | | | 1015 |

# THE PRESIDENT'S ADDRESS.

FRANK BILLINGS, M.D.

## THE TREND OF THE PRACTICE OF MODERN MEDICINE.

I am mindful of the fact that the constituent associations of the congress were organized for scientific purposes only; that discussions of policies or ethics which affect the medical profession as a whole were not to be introduced into the meetings. I crave your indulgence with the hope that I may justify the presentation of a subject which, in my opinion, demands your earnest consideration.

### *Postwar Conditions.*

It is evident that, since the close of the great war, the state of mind of the people of the whole world has been characterized by reactionary ideas in regard to governmental policies, education, industry, employment and other human activities. Reconstruction on new lines is suggested to overcome alleged past and present social and other evils, with the naïve assurance that the proposed reforms will insure universal prosperity and happiness. The public health and welfare, including medical education and medical practice, are embraced in the general plan of reconstruction. It is generally recognized that a large measure of these reactionary ideas are sequences of the war, and that time and the application of good common sense in the adoption of the proper remedies will bring us back to the safe and sane conduct of individual and community life. However, there are some human activities in which, before the war, there had developed recognized productive benefits, but in which, at the same time, the methods of administration and application of these human interests lessened their value to society; and these deleterious conditions were aggravated during the war, and have been since it ended. [Among these activities I include the practice of medicine.]

## *Modern Medicine.*

During the last fifty years the study and evolution of chemistry, physiology, pathology, bacteriology and sanitation, and their application in the prevention, diagnosis and treatment of disease, have changed and broadened medicine to such a degree that its practice is designated an applied science. This does not imply that it is now or that it ever will become an exact science; but by means of continued laboratory and clinical research, the medicine of to-morrow will be characterized by increased learning of greater value to mankind than is the medicine of to-day. The practice of medicine, however, will always be an art rather than an applied science; for the benefits of the application of the knowledge which the fundamental sciences afford in clinical medicine may be measured by the technical skill and the experience—the art—of the physician.

The study of physiology and biochemistry has brought about a revision of the older anatomic conception of disease. While to-day we are interested still in the morbid anatomic lesion, its etiology, nature, evolution and its modification by management and treatment—we have quite as much or a greater concern in the coincident functional disorder. In other words, the study and knowledge of pathologic physiology is now recognized as of the greatest moment in modern medicine.

Modern clinical medicine embraces such a vast field of knowledge that it is beyond the power of any individual to acquire the necessary learning, experience and technical skill to practice efficiently in the whole field of medicine. A recognition of this has led to the necessary specialization in medicine, with the evolution of the internist and of other specialists in the narrower fields of medicine and surgery. The wonderful beneficial results of the application of asepsis have made the modern general surgeon a specialist. The evolution of medicine and the promotion of specialism have resulted in the invention of instruments of precision and the elaboration of laboratory methods of physical and functional diagnosis which require special technical skill and experience in their application. In consequence, diagnosis, both physical and functional, has become more precise and at the same time complex. We recognize the enormous benefits which these methods of diagnosis have brought to medicine, and the fact that their employment will bring additional useful knowledge; but we must ever keep in mind that many of these

complicated methods of diagnosis are of use chiefly in the investigation of disease rather than in routine practice.

### *Modern Medical Practice.*

Specialization in medicine developed rapidly before the war, and it may be said that the result was generally beneficial to clinical medicine and surgery, and to the public; but an early tendency to overspecialization became evident. During the period in which the United States participated in the war, more than 30,000 civilian practitioners volunteered and accepted commissions as temporary officers in the medical department of the army. This large number of civilian doctors exerted an enormous influence in the organization of the medical corps of the National Army for service in administration and in the field. Specialization in organization resulted to such a superlative degree that eight different administrative divisions, with as many groups of specialists, were formed to care for that part of the anatomy of the soldier designated as the head. Clinical divisions, approximately twenty in number, were organized with separate groups of specialists on duty at headquarters and in the field to care for the designated anatomic portions of the soldier when sick and injured. This organization of the medical department of the army into special groups was maintained throughout the war. The question of jurisdiction over certain anatomic parts of a sick or disabled soldier caused more or less dispute and heartburning among both administrative and field officers. The efficiency of both medical and surgical service was good generally, as evidenced by the relief of suffering, cure and prolongation of life. But in this experience of the application of specialism in military medical service, all factors were such as to promote success under any well organized plan for medical and surgical care. The population cared for consisted of young men mobilized in camps, usually with good diagnostic and hospital facilities available, and the requisite medical and other personnel. Military discipline was a helpful factor, and, until the armistice, the morale as a rule was excellent, and promoted recovery from disease and injury.

The recognition and promotion of specialism in the medical corps of the army during the war greatly stimulated the amplification of specialism in civilian practice. Many physicians and surgeons who

were general practitioners when they enlisted were so impressed and pleased with the special service which the army experience afforded that they have continued to attempt the practice in the respective narrow fields since returning to civil life. As a natural consequence, in civil practice they feel responsible, as they did during military service, merely for the particular anatomic part of the patient which is the apparent seat of a morbid process or injury; for specialization in medicine is likely to induce a loss of perspective, and the patient is viewed no longer as a human being but solely as a case. It is asserted that this form of practice is ultra-scientific, which may be admitted, and that it is to become the only proper form of efficient medical service. Overspecialization has promoted group practice.

### *Group Practice.*

For many years, group medical practice has existed in hospitals conducted by medical educational institutions, and in some public hospitals. The members of the group include members of the hospital staff. In these groups there has been no organization which provides for the charge of a single fee for the services rendered the patient by participating clinicians. The patient is referred to the available specialist on the staff and in the group, who gives an opinion and collects his own fee. Similar forms of group practice have always existed among private practitioners with the mutual understanding of individual independence in regard to the financial remuneration for services rendered.

In recent years, overspecialization in medicine has led to the organization of private practitioners into groups, with representatives in the membership of general or internal medicine and surgery and of most or all of the specialties of medicine and surgery, including laboratory specialists for the purpose of affording greater efficiency in practice. Since the end of the war, the movement toward group practice has expanded rapidly. In some cities several groups have been organized, and in some places active competition to obtain patients exists between the groups, as is evidenced by announcements in the public press indicating the superior advantages offered by the staff, and the available diagnostic and hospital facilities for the care of the sick and injured. The organization of diagnostic and treatment pay group clinics is a more recent development. The suggested advantages of group practice include more efficient diagnostic and

therapeutic service; financial economy to the patient, because the one fee charged for the total service rendered is adjusted to meet, without embarrassment, the financial resources of the patient; and professional co-operation in substitution of the prevailing individualism in medical practice.

Now we will all agree, probably, that private and public group practice is a distinct advance in medical service to a community; but it must be evident to all that its application has distinct limitations. To be of real value to the profession and to the public, the group clinic must be conducted on fundamental principles and policies which are characterized by intellectual and professional honesty, and by unselfish and sympathetic understanding of the needs and the welfare of the public, including the members of the medical profession, unconnected with the group, in the community it serves. In other words, the private and public group clinic should be conducted under the same standards of ethics as those recognized and adhered to by the conscientious and honest individual consultant in his relationship to the members of the medical profession and the public. The individual consultant who retains and treats the patients sent to him for diagnosis by a physician, or who attempts to promote his practice by methods tantamount to advertisement in the public press, is unworthy of the confidence of the members of the medical profession and of the public.

I have stated that the value of the application of group practice is limited. I believe that this is true. Let us see. Ostensibly the group is formed for the avowed purpose of providing all patients with an accurate diagnosis and efficient treatment. This is made possible through the services of clinical and laboratory specialists and available equipment to obtain a precise knowledge of the physical and functional condition of the patient and to afford efficient general and special treatment, including hospital care, if that is deemed necessary. First, let us inquire how many patients of an average community require the application of these precise methods of diagnosis to arrive at a true understanding of the real condition, and how many of these patients require hospital care. Based on long experience in consultation and in general hospital and private practice, it is my opinion that a correct anatomic and functional diagnosis can be made in from 80 to 85 per cent. of all the patients of an average community by a qualified, industrious, painstaking general practitioner by the sole application of the trained mind, the

special senses, the hands and an always available simple laboratory equipment. Likewise, approximately 80 per cent. of the patients will receive efficient management and treatment as ambulatory or house patients. Of course, it is advantageous that every hospital, with the possible exception of some very small or special institutions, should have the necessary laboratories, equipment and trained technicians to make these precise examinations and to afford adequate treatment of the few patients who really require their use. So, too, must the organization of private groups of practitioners who will make these ultrascientific methods of practice available for those patients whose morbid conditions demand their use be commended and supported.

The truth is, the splendid knowledge which modern medicine has made available in the diagnosis and treatment of disease is misapplied frequently, with unfortunate derogatory effect on the public and the tendency to demoralize some members of the medical profession. In substantiation of this statement I will cite the establishment of public clinical laboratories. In recent years the number of these institutions has increased far beyond the need. Fundamentally, their services are useful to the members of the medical profession, by furnishing them the needed laboratory examination of a special character. These laboratories also provide for the routine examinations which are simple in character, the greater part of which should be done by the practitioners themselves with the required inexpensive and simple equipment always available. For their own benefit, medical practitioners should carry on personally their own clinical laboratory and physical investigation of the condition of their patients. For the more elaborate laboratory tests, such as blood chemistry, serology, electrocardiography, radiography and some functional tests requiring technical skill and experience, they should make use of the public clinical laboratories. However, the use of these refinements in diagnosis, which are costly, has been stimulated by propaganda distributed by the directors of these public laboratories, through advertisements in medical journals and by circulars sent in the mail to practically all members of the profession. In some instances the attempt is made in the statements published to emphasize the importance and the great need of these methods of refinement in diagnosis in routine practice. Through these and other influences, these refinements in diagnosis, always paid for by the patient either directly or indirectly, are unnecessarily

used. Too often the necessary primary and fundamental physical examination is not made, or, if it is, not as thoroughly as it should be. In other words, the patient as a whole and as a human being is not considered. Over and over again, an erroneous diagnosis is made on the basis of the laboratory findings, which would have been avoided and the correct diagnosis established by available simple methods of examination.

This method of practice, and the false impression gained by the public through private and public group medical and surgical service with the usually attendant high cost, are tantamount to commercialism. The public is slowly but surely becoming aware of these conditions in medical practice. Evidence of this point of view of the public is expressed by lay people in cities and in the country. Frequently the best families of the city inquire whom they may secure as a family physician. They ask, "Where can we find the resourceful, painstaking, sympathetic family physician who attended us or our parents' families in former years?" In this connection we must remember that the splendid character and accomplishment of the United States government are due in no small measure to the character-forming factor, the family home. The modern tendency in the cities, especially among the foreign-born population, is to seek tenement habitation, which tends to minimize the value of family life and to disregard the responsibilities of citizenship. This tends to engender the worst forms of socialism, and disregard of individual and community responsibility in the observance of the laws of sanitation, and also to promote disease and poverty. The future safety, prosperity and health of the people and the maintenance of all the benefits which this republic affords demand the preservation of the character-building family home.

As a factor in this necessary principle of community welfare, the family physician and his domiciliary visits are essential. It is recognized that the general practitioner, both in the city and in the country, lacks sufficient hospital facilities in the care of his patients. This lack is evident in some of the rural districts of practically all the states of the Union. Some feasible constructive program should be adopted which will afford justice to the taxpayers and to the members of the medical profession, and which will provide better hospital and diagnostic facilities where they are needed. We must, however, keep in mind the fact that a majority of patients do not require the application of unusual and refined methods of diagnosis,

and also that a majority do not require hospital care. The pretentious program of some members of the medical profession and of uninformed members of the public for the irrational amplification of hospital beds for the treatment of practically all the ill and injured, is unnecessary and uneconomical, and promotes the disorganization of society.

### *Medical Education.*

We are justly proud of the satisfactory standards of medical education in the United States. This standard of medical education is evidenced by the general excellent professional qualification of the graduates of recent years. Never before in the history of the United States have so many members of the medical profession been so well qualified for efficient service to the public. Never before this period have there been so many opportunities for medical service to the public. The graduates of recent years readily find opportunity for laboratory and clinical service to the public, and also opportunity to teach and to carry on investigations in various lines of research, with financial remuneration which is greater than that received by young professional men in former years.

The tendency to specialize in all lines of professional service has had its influence on the character of the education and training of the undergraduate medical student. The majority of the teachers in the medical schools of the country are specialists in practice, and it is natural that each should emphasize in his teaching the importance of a given specialty. In consequence, too much of the time of the student is occupied in the accumulation of unimportant facts relating to special subjects, which deprives him of the necessary time for the needed broad and comprehensive instruction and training in the fundamental principles of pathology, general medicine and surgery, and obstetrics.

The constituent associations of this congress have a membership which includes the foremost medical teachers, research workers and specialists in the pre-clinical and clinical branches of medicine. The membership stands for the highest ideals of the medical profession, and is qualified and should assume the responsibilities of leadership in the solution of the problems which affect the efficiency of medical practice and the health and welfare of the public. The members of the congress should use their influence to promote the

adoption of a fundamental curriculum having as its purpose the proper education of the general practitioner.

The tendency to overspecialization in the practice of medicine has tempted many inadequately trained members of the profession to take up special lines of work. There are too many specialists of this kind in practice to-day. To correct this condition, it is my opinion that the members of this congress should promote and develop opportunities in various parts of the country for the adequate postgraduate training in the several specialties of medicine and surgery.

Finally, permit me to assure you that there is no member of the congress who more fully recognizes and appreciates the value of the facilities which modern medicine affords in the practice of medicine, than I. My endeavor has been to point out what in my opinion are very important and serious errors in modern medical practice, which are injurious to the members of the medical profession and very unjust to the public. I have confidence and faith in the honor and integrity of the medical profession. I believe that its past history, characterized by the highest motives, self-sacrifice and productive service to the public, will enable it voluntarily to correct existing conditions detrimental to medicine and to society. Furthermore, I have tried to impress upon the members of the congress the necessity of preserving that individualism in medicine which implies broad professional qualifications combined with resourcefulness and desire, above every other consideration, to give efficient service in the relief of suffering and the prolongation of life.

# FACTORS WHICH ENTER INTO AN ADEQUATE DIET.

E. V. MC COLLUM, M.D.
*Johns Hopkins University.*

During the last decade it has been established by experiment that there must be supplied in the diet of man and certain of the lower animals, e.g., monkey and guinea-pig, three substances or groups of substances which have not as yet been characterized chemically. There is much reason to believe that a fourth substance, which should be classed with these as vitamins, has been demonstrated in connection with its directive influence on the anatomic elements concerned in bone growth.

The first three of these substances are usually designated by algebraic symbols as fat-soluble A, water-soluble B, and water-soluble C, or simply as vitamin A, vitamin B, and vitamin C. The belief in the existence of these substances rests entirely upon observations relative to the symptoms which develop in experimental animals when a single one of them is omitted from the diet which is otherwise satisfactory. The syndromes which develop are collectively spoken of as "deficiency" diseases, or "avitaminoses." The specific deficiency diseases which are generally recognized by investigators are an ophthalmia of dietary origin, beriberi or polyneuritis, and scurvy. The etiology of these is attributed to specific fasting for the vitamins A, B and C respectively.

The studies of the last few years have clearly shown that there is a group of disorders which must be referred to as malnutrition, but which are not the result of specific dietary deficiencies as are ophthalmia of dietary origin, beriberi, and scurvy. In this group we now include rickets, pellagra, coeliac disease, edema of a certain type which has frequently appeared during war or famine, or among miserably fed prisoners. These conditions may properly be designated the non-specific deficiency diseases. Of these the best understood from the standpoint of etiology is rickets.

Since Dr. Shipley will consider this disease in some detail I shall state only that we regard rickets as due to an unfavorable relation between the content of calcium, of phosphate and of a substance which is abundant in cod liver oil, and which occurs in small amounts

in various foods. It involves, therefore, three dietary factors in its etiology.

Pellagra is certainly due to the consumption of a faulty diet, and several kinds of experimental evidence has been brought forward to establish this view. The experimental evidence which has been published seems to be less conclusive in pointing to the etiological factors than in the case of rickets. Dr. Goldberger has been actively studying this problem for many years, and I believe he has some new results which he may be ready to make public to-day.

In malnutrition of a rather severe type in which there is a vitamin factor of sufficient severity to terminate in a specific deficiency disease, as is frequently seen in beriberi patients, but in which several dietary factors are at fault, there frequently develop profound disturbances of digestion, and serious injury to the alimentary tract. We owe to McCarrison our appreciation of this important fact. Beriberi was formerly regarded as essentially the result of a nerve lesion which resulted in loss of motor function, but it has been shown that the damage is general in all the tissues, and that the digestive tract is especially damaged.

Edema has been shown to result from deficiency of protein in the diet, and it seems plausible that the edema which has been frequently observed in war and famine, and in prisons, is closely related to that seen in wet beriberi, which distinguishes this from the dry form.

Deficiency of the vitamin A, or fat-soluble A, leads to the development of an ophthalmia of dietary origin. Little is known as yet concerning the details of the pathology of this condition. It is known that there is a xerosis of the conjunctiva and a keratomalacia, resulting in perforation of the eyeball. The improvement of the eyes of experimental animals suffering from this disease is very spectacular. We have no knowledge concerning the mechanism of the action of the protective substance, the factor A, either in preserving normal function or in its action as a curative agent.

Numerous experiments have revealed the distribution and relative abundance of each of the vitamins in different natural foods. Fat-soluble A is not very abundant in most vegetable foods which have the function of storage tissues, such as the seed grains, tubers and fleshy roots. There seem to be a curious exception in this rule in the case of certain yellow pigmented roots and seeds, such as carrots, yellow turnips, yellow corn, etc., which are relatively rich in it,

whereas white or red varieties are almost or quite lacking in this vitamin. It has however, not been possible to establish any constant relationship between yellow pigmentation and content of fat-soluble A. Muscle meats are very deficient, whereas glandular organs are very good sources of it, as are also milk fats, egg yolk fats, cod liver oil, and the leaves of plants where these have not been modified as storage tissues. Vegetable fats and oils are without exception essentially lacking in this substance.

Water-soluble B is very widely distributed in our natural foods. The only articles of food which enter largely into the American diet which are deficient in it are polished rice, sugar, fats of both animal and vegetable origin and the highly milled cereal foods such as bolted flour, degerminated corn meal, and starch. This vitamin is the one which we are least likely to secure in sufficient amount. Since the commercial vitamin preparations on the market are in many instances stated to furnish only this one of the vitamins it is unfortunate that such preparations are being promoted for therapeutic purposes. It is easy to plan a diet which will furnish a great abundance of all the vitamins and in fact any diet which is highly satisfactory in other respects, will certainly afford all of the uncharacterized dietary essentials which the body requires. Furthermore, we have recently tested a considerable number of commercial vitamin preparations and have found them in most cases worthless for the specific purpose for which they were advertised. The place to get the vitamins is in the market and the grocery store, and not in the drug store.

The third vitamin whose existence has become well established is that which affords protection against scurvy. In order that an adequate supply of this factor shall be provided, it is essential that a certain amount of some raw foods be taken regularly. For this purpose the regular consumption of salad dishes containing raw fruits, raw cabbage, lettuce, etc., in addition to the other ingredients which enter into the making of appetizing salads, is to be recommended. Cooked, dried or stale foods have all lost most of their antiscorbutic value.

One of the most important advances which nutrition studies have achieved in recent years is the establishment of a full appreciation of the sensitiveness of the animal body to an improperly adjusted inorganic content. The importance of the calcium content of the food is especially to be emphasized, since there is much reason to believe that

most people, living as they are on a diet consisting in great measure of white bread, meats, potatoes and sugar, do not ingest sufficient calcium. The ease with which the bones are affected by unfavorable quantitative relations between the calcium and phosphate content of the diet, is another case in point. The need for a more abundant supply of iodine in the food of people in certain goiterous regions, seems to rest upon sufficient observations.

The quality of the proteins in the diet has been the subject of much careful study, and it has been well established that many of the proteins of plant tissues, especially seeds and tubers, are not of very good quality for transformation into tissue proteins in growth. It has been shown, however, that the proteins of milk and of meats are especially valuable for enhancing the proteins of the cereals and legume seeds, so that these have an unique importance as supplementary foods, for the purpose of making more available the digestion products derived from many vegetable foods.

A striking fact which is well established by experimental studies is that it is not possible to prepare a satisfactory diet from cereal grains, legume seeds, tubers, fleshy roots and muscle cuts of meat. All such combinations will be unsatisfactory in that they are too low in calcium, and almost all combinations derived from this list of foods will contain less than the optimal amount of fat-soluble A. Unfortunately, the meats, which are so attractive from the standpoint of palatability that they regularly find a prominent place in the American dietary, do not enhance the bread, meat, sugar and potato type of diet with respect to either fat-soluble A or calcium. The only foods which are available in quantity for this special purpose are milk and the leafy vegetables.

A very valuable contribution to the science of nutrition in recent years was the discovery that the leafy structures of plants possess unique dietary properties, and are not only in themselves superior to the foods which are functionally storage tissues of plants, but that they are especially well constituted to correct the deficiencies of cereals, tubers, roots and meats. The leafy vegetables stand in the same class with milk in their value as supplemental foods. For this reason I thought it well several years ago to distinguish milk and the leafy vegetables from all other ordinary foods, as the protective foods. They should be first considered in planning a diet, and only after sufficient amounts of these have been provided, should the

remaining articles in the food supply be selected. If sufficient amounts of the protective foods are taken it matters little what is the source of the remainder of our diet, for no very serious mistake is likely to be made.

You will hear from the other speakers to-day much about the deficiency diseases. I should like to point out my belief that in the aggregate, the evil effects of malnutrition of a borderline type greatly overshadow the clinically recognizable deficiency diseases in importance. We have but relatively few cases of beriberi, scurvy or ophthalmia of dietary origin in this country, but we have a great deal of malnutrition. Approximately twenty per cent of the children in the public schools to-day are seriously under weight and in great measure because we derive too large a part of our diet from white bread, and other cereal products having similar dietary properties, meats, sugar and potatoes. Many demonstrations of the fact are available, that children who are under weight respond with rapid growth when they are furnished with a more satisfactory food supply.

The simplest manner in which we can formulate the best advice as to how a highly satisfactory diet can be assured is as follows: We should take twice each day a salad dish containing a certain amount of raw fruit and vegetables; once a day a liberal serving of such a dish as we class as greens or pot-herbs; and every day the equivalent of one quart of milk per person. In this system of diet, we borrow the best feature of the Oriental diet, and replace a portion of our milled cereal foods by foods of greater value from the physiological standpoint. This plan provides for a sufficient amount of the protective foods.

Our studies have made it clear that the quality of the teeth is in great measure determined by the character of our nutrition during the time that the teeth are developing. The prevalence of early tooth decay, skeletal defects, and underdevelopment of our children are sufficient evidence of the necessity of a reform in our diet. I desire to urge upon the medical profession a consideration of the place of nutrition as a factor in preventive medicine. The system of diet which I have briefly sketched is one which does not disturb our long established dietary habits, and will go far toward doing away with our present unenviable prevalence of borderline malnutrition.

# EXPERIMENTAL EVIDENCE OF THE LACK OF VITAMIN B IN NUTRITION.

LAFAYETTE B. MENDEL.

*Professor of Physiological Chemistry, Yale University, New Haven, Conn.*

In boasting of its unprecedented progress in the fields of science the present generation cannot overlook the important rôle which the experimental method has played in what has been accomplished. "Ancient medicine," says Frederic S. Lee, "is characterized pre-eminently by philosophical speculation and empiricism; modern medicine by experimentation. The ancient physician was content to observe phenomena as they existed under their natural conditions, to interpret them in accordance with a philosophical system, and to treat disease in the light of what his system and past experience had taught him. The modern physician does not rely on a philosophical system. Like his forerunner, however, he, too, observes phenomena under their natural conditions; but he goes further than this and alters the conditions, and thus he obtains an alteration of the phenomena and a new standpoint from which to view them. He may apply to the cure of disease past experience, it is true, but it is past experience that has been put to the test of modern experiment. Moreover, by the aid of further experiment he pushes out into the unknown, sees disease from unusual standpoints, and devises new and hitherto unsuspected methods of dealing with it. If he forms a working hypothesis, it, too, has to be submitted to experimentation, for men of medicine have little patience with a new idea that has no experimental evidence in its favor."

In the rapid development of the vitamin hypothesis, in particular, experimental investigations of the modern type have led the way. It would be futile to rehearse the story at this time. Many of the details of the discovery of the food factor now commonly designated as vitamin B are already familiar to you. Two quite independent series of researches have contributed most to the elucidation of the subject. One was the outcome of the study of beriberi. When Eijkman found, about a quarter of a century ago, that by feeding fowls on polished rice he was able to produce symptoms comparable with those of beriberi in human patients it became possible to under-

take experiments extensively. Eijkman himself early described the experimental disease as a "nutritional polyneuritis"; and, as Sherman and Smith remark, the probable "existence of an antineuritic substance as something different from the known foodstuffs, but essential to normal nutrition, was clearly discovered by Eijkman long before the term vitamin was proposed." (The Vitamins, p. 9.) Here again, as so often in the medical sciences, the opportunity to employ animals for study without the limitations of investigation in man has been an important factor in efficient advance. Experimental polyneuritis gallinarum paved the way for the interpretation of beriberi as an avitaminosis.

The second important group of experimental evidences pointing to the existence of hitherto unrecognized food factors esssential to adequate nutrition is represented by the data secured from feeding trials with mixtures of purified foodstuffs. The failure of such rations to satisfy test animals had repeatedly been recognized long before the true significance of the observations was appreciated. In a generation trained to look enthusiastically for sources of disease in active agents like micro-organisms and to find the materies morbi in harmful chemical substances, the conception of a dietary deficiency as the harmful factor was slow in arriving. The oft-quoted prophetic utterance of Hopkins in 1906 remained essentially a conjecture for several years. Thus he said:

"No animal can live upon a mixture of pure protein, fat and carbohydrate, and even when the necessary inorganic material is carefully supplied, the animal still cannot flourish. The animal body is adjusted to live either upon plant tissue or other animals and these contain countless substances other than the proteins, carbohydrates and fats. Physiological evolution, I believe, has made some of these well night as essential as are the basal constituents of diet; lecithin, for instance, has been repeatedly shown to have a marked influence upon nutrition, and this just happens to be something familiar, and a substance that happens to have been tried. The field is almost unexplored, only it is certain that there are many minor factors in all diets of which the body takes account. In diseases such as rickets, and particularly scurvy, we have had for long years knowledge of the dietetic factor, but though we know how to benefit these conditions empirically, the real errors in the diet are to this day quite obscure. They are, however, certainly of the kind which comprises

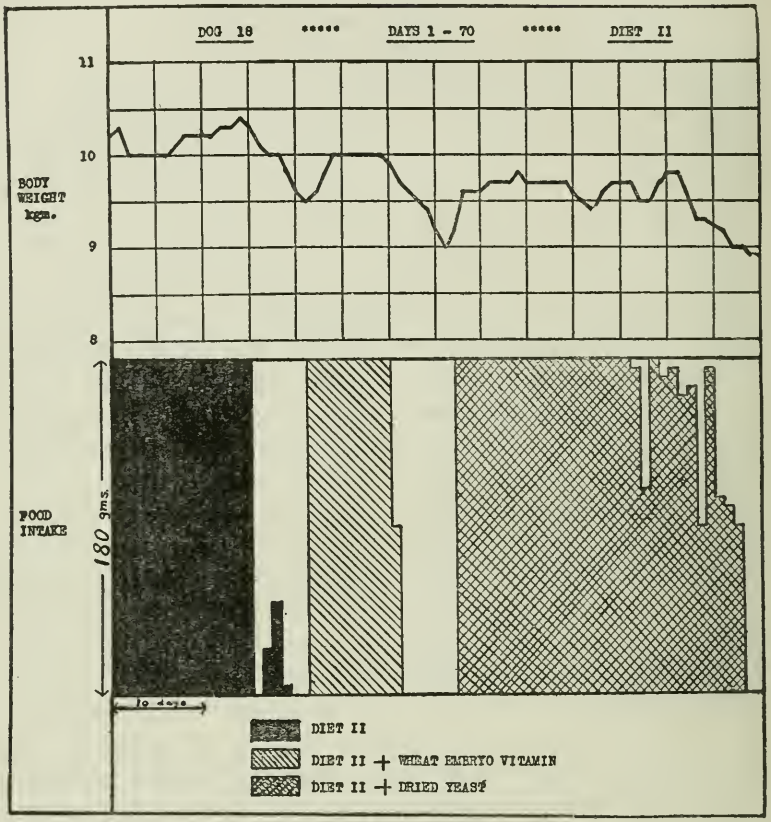
these minimal quantitative factors that I am considering. Scurvy and rickets are conditions so severe that they force themselves upon our attention, but many other nutritive errors affect the health of individuals to a degree most important to themselves and some of them depend upon unsuspected dietetic factors."

To-day we know, thanks to the concordant experimental studies conducted in a number of laboratories, that there are several of these "unsuspected dietetic factors." Although their chemical nature is in no case as yet identified, the evidence for the existence and need of the vitamins is already beyond question. Vitamin B is distributed very widely in both plants and animals.

What are the evidences for the lack of this food factor in a living organism? Before reviewing the accumulated facts it may be well to point out that much of the experimentation, particularly in the earlier period of research in this field, has been decidedly inadequate to furnish clear-cut answers. Like many clinical studies of physicians, the nutrition experiments of physiologists and biochemists all too often involved so many variables that the cause of deviation of results from the normal could not be determined with any approach to certainty. Instead of one there were often several omissions from the list of known essentials. For example, it is not surprising that an animal fails to thrive on a diet of polished rice alone. This single food is obviously inadequate to supply a sufficient intake of inorganic nutrients for any protracted period, not to mention the problem of a quantitatively and qualitatively adequate quota of protein. A mouse fed on purified protein, starch and bicarbonate of soda likewise obviously cannot thrive, for reasons long clearly discerned. Only when the energy supply is abundant, the protein and salts are chemically and quantitatively suitable, and the nutrients are digestible can it be said that some approach at least to suitable provision of known essentials other than the vitamins has been made.

When such "otherwise adequate" diets are offered to animals it is consistently noted that they soon decline to eat sufficient food. This "lack of appetite," whatever may be its ultimate cause, is manifested by various species already studied experimentally. It is shown by a more or less rapidly ensuing decrease in food intake by birds, rats, mice, dogs and cats among the animals with which I have had personal experience and for which accurate quantitative data are available. The illustrative charts show the character of this refusal to

eat—likewise the change brought about by the therapeutic administration of suitable adjuvants to the purified diets which remain otherwise unchanged.

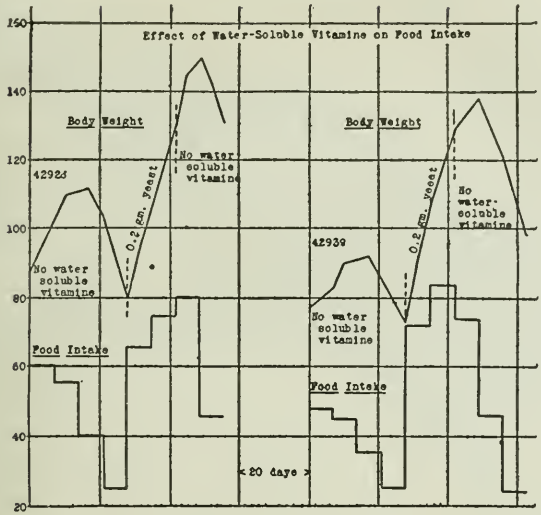



*Diet II.*

| | Grams. |
|---|---|
| Commercial casein (12.7 per cent. N.) | 6.3 |
| Sucrose | 4.5 |
| Butter Fat | 1.1 |
| Lard | 2.8 |
| Bone ash | 0.4 |
| Salt mixture | 0.2 |
| Water | 2.7 |
| | 18.0 |

Containing 0.8 gram N. and 80 calories.

Illustrating the effect of vitamin upon food intake in dogs.




The lower line shows the grams of food eaten each week. During the first period, on a diet free from water-soluble vitamin but otherwise adequate, food intake gradually fell to a very low level. When daily doses of 0.2 gram brewers' yeast were fed body weight and food intake increased with great rapidity. When the yeast was withheld body weight and food intake, after a few days, rapidly declined. Note that during the first week of the vitamin feeding Rat 4293 ate a quantity of water-free food equal to its own body at the beginning of the week.

Illustrating the effect of vitamin upon food intake in rats.

Such observations seem to me to point to one, if not actually the foremost, possibility in the domain of so-called vitamin therapy—the promotion of appetite or food intake where it is decreased owing to a restricted diet. Convalescents are all too frequently limited to a diet of milled cereal products, jellies, soups, meat and fish—all demonstrably poor in vitamin B. Such patients are also all too often indifferent toward food and consequently slow in their nutritive recovery. Is it not timely in such cases to transfer to the clinic the experience gained in the dietotherapy of the laboratory animals?

Inadequate calorific intake is not the only consequence of a lack of vitamin B in the diet. Sometimes the latter, though deficient, is consumed in sufficient quantities to prevent serious loss of body weight for a long time. In that event disorders of the nervous system may ensue. Early recognized in human beriberi and the experimental polyneuritis of birds, comparable symptoms have been noted

in other species. Most recently Cowgill has studied them in the dog in my laboratory.

With this animal, in nearly every case vomiting appears as the first symptom to be noted. In some instances vomiting has occurred at intervals of one or two days for a week or more before other symptoms have appeared; in other cases, the gastric disturbances have been followed within the course of a few days by nervous symptoms involving the voluntary musculature. This syndrome consists essentially of a paralysis involving at first the muscles of the hind limbs and later those of the neck and fore limbs, and characterized particularly by a condition of tonic spasticity of the muscles involved. If treatment is not begun, the paralysis becomes more pronounced; instead of showing merely an incoördination of gait, the animal becomes helpless with all four limbs in extension, and clonic spasms are exhibited when the dog is handled; convulsions involving the muscles of the neck and jaws appear and the animal finally dies. If a sufficient amount of vitamin B is administered before the advanced stages shown by the severe convulsions are reached, relief from all of the nervous symptoms results—a relief which may be very dramatic and occurring in from one-half to four hours if a suitable preparation containing the vitamin be injected directly into the blood stream.

Recovery is surprisingly prompt when suitable food products are supplied by oral, subcutaneous, intramuscular or intravenous paths. A fruitful field is here opened to the pathologist for study. The idiosyncrasies of food consumption ensuing on a dietary deficient in vitamin B may bring about multiple inadequacies of the intake and thus explain the diversity of the manifestations in individual cases.

The pictures presented by some of the recoveries referred to are almost dramatic in character. Every worker in this domain will have seen animals moribund after a vitamin-free regimen rapidly restored by a small supplement to the latter. It is this marvelous response that doubtless has been responsible for the obtrusion of so much ridiculous and most unjustifiable propaganda for widespread use of alleged vitamin-bearing nostrums. We must not let our aversion to quackery make us unmindful of the truly remarkable phenomena which the newer study of the vitamins has revealed. Pepsin, radium, thyroid, arsphenamin and many other notable contributions have had a somewhat similar history.

McCarrison in particular has lately insisted that a deficiency of

Fig. 1. Polyneuritic dog. This animal had been fed for 83 days on a diet lacking vitamin B. A very slight paralysis involving the hind limbs became evident on the 60th day; on the 74th day the paralysis became pronounced. Photograph was taken on the 83d day.

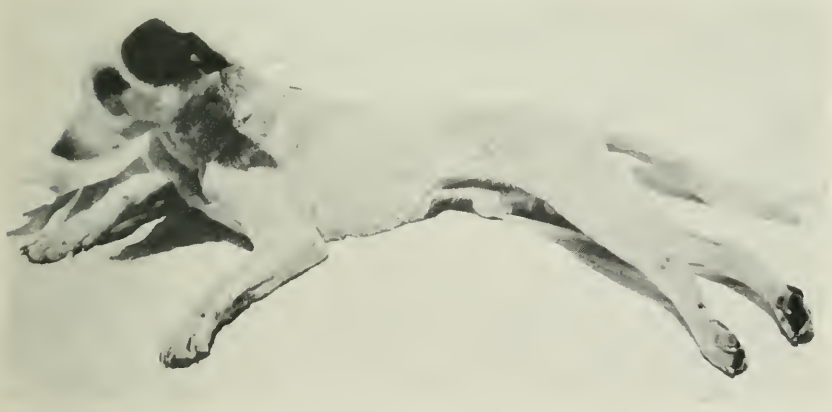


Fig. 2. Same animal as is shown in figure 1, photographed on the 83d day. Notice that the muscles of the hind limb are contracted even when the animal is lying down.

(From Cowgill, G. R.: Am. Jour. Physiol., 1921, **57**, 420.)

Fig. 3. Polyneuritic dog. The leg muscles were vigorously contracted, especially those of the hinder extremities, resulting in extension of all the limbs and inability of the animal to stand. If this dog was handled, severe clonic spasms resulted.

Fig. 4. Same dog as is shown in figure 3, 18 hours later and showing the effect of administering neutralized tomato juice. After such treatment the animal was able to walk although with a characteristic spastic or "steppage" gait. After repeated treatment extending over 4 days, the spasticity of the leg muscles and spastic gait almost entirely disappeared.

(From Cowgill, G. R.: Am. Jour. Physiol., 1921, **57**, 420.)

vitamins, including vitamin B, may give rise to pathological manifestations other than those more specifically referred to in the foregoing discussion of the experimental status of avitaminosis.* His experiments are not always free from the criticism of uncontrolled variables already mentioned; and inasmuch as the conclusions take us into the somewhat nebulous domain of endocrinology they will not be reviewed in detail here. In his Mellon Lecture at Pittsburgh last November Colonel McCarrison drew the following conclusion from his own investigations:

"The health of the gastro-intestinal tract is dependent on an adequate provision of vitamins. The absence of growth vitamins is capable of producing pathologic changes in the tract which frequently assume the clinical form of colitis. This observation is of the highest importance in view of the frequency with which this malady is encountered at the present day. Deficiency of vitamin C is especially concerned in the production of congestive and hemorrhagic lesions in the tract, and evidences of these may be found in animals which have not exhibited during life any of the clinical manifestations of scurvy in noteworthy degree. A state of ill health of the gastro-intestinal tract may thus be a prescorbutic manifestation of disease due to insufficiency of this vitamin, especially when associated with an excess of starch or fat or both in the food. The disorder of the gastro-intestinal tract consequent on vitamin deficiency is enhanced when the food is ill balanced."

Studies as yet incompleted in our laboratory make it seem not unlikely that derangements of the alimentary tract, notably the motor functions, may become an expression of avitaminosis. Wright,† too, believes as the result of his experimental studies that "vitamin B acts by facilitating the efficient carrying out of the functions of the intestinal canal. The main effects produced by the absence of the vitamin—i. e. diminished food consumption, loss of weight, and ultimate death—are due to intestinal stasis and the absorption of toxic bodies which results therefrom."

The suggestion made by several writers that vitamin B promotes secretion somewhat as does the gastric or pancreatic secretions or

* The reader will find a summary in Sherman, H. C., and Smith, S. L.: The Vitamins, 1922, p. 54; also McCarrison, R.: Faulty Food in Relation to Gastro-Intestinal Disorder. Mellon Lecture, 1922.

† Wright, S.: The Effect of B-Vitamin on the Appetite. Lancet, Dec. 10, 1921, 201, 1208-1209.

the drug pilocarpin has not received any support from the investigations of Cowgill in my laboratory, Drummond in England, or Miyadere in Japan. Nor is there any conclusive evidence that either the availability of food or the metabolic transformations in the organism are directly controlled by vitamin B. Cramer and his co-workers in London* recently expressed the belief that "a specific relationship exists between the water-soluble B-vitamin and lymphoid tissue in the sense that the formation of lymphocytes is impaired in the absence of this vitamin." With respect to the mode of action of B-vitamin deficiency these English investigators conclude that "the lymphocyte has an important and specific function in maintaining the nutrition of the cells of the body, and the disturbances in nutrition which follow the withholding of B-vitamin are secondary to a specific lesion which leads to an interference with the functional activity of the lymphoid tissues." They agree that in experimental animals absence of the water-soluble B-vitamin leads to characteristic nutritional disturbances such as loss of weight, emaciation, subnormal temperature which may be designated by the term "marasmus." No such marasmus results from withholding the fat-soluble A-vitamin. The lymphopenia established by withholding the water-soluble B-vitamin is rapidly abolished by the administration of the water-soluble B-vitamin and, pari passu with it, the concomitant marasmus. Cramer and co-workers oppose the conception that vitamin B is necessary for the maintenance of every individual cell. "This vitamin," they remark, "is necessary for the maintenance of life of a highly differentiated animal not because its presence is necessary for the life of all the cells of such an animal, but because its presence is necessary for the normal functioning of lymphoid tissue. In other words, the term 'deficiency diseases' is, like the term 'vitamin,' a misnomer. These diseases have their origin, like other diseases, in specific lesions. These lesions may be induced by different agencies of which a deficiency in vitamins is only one."

It would be unfortunate to-day to elevate the many guesses on the subject at this time to the dignity of well-founded beliefs. The story of the physiology like that of the chemistry of the vitamins is still in the making.

* Cramer, W., Drew, A. H., and Mottram, J. C.: On the Function of the Lymphocyte and of Lymphoid Tissue in Nutrition, with Special Reference to the Vitamin Problem. Lancet, Dec. 10, 1921, 201, 1202-1208.

# DISTRIBUTION AND PROPERTIES OF VITAMIN C.

H. C. SHERMAN, PH.D.

*Professor of Food Chemistry, Columbia University.*

Nearly all of our accurate knowledge regarding the distribution and properties of vitamin C rests upon data determined by means of laboratory experiments with guinea-pigs.

As early as 1895, Theobald Smith* noted that guinea-pigs kept upon a diet of oats developed a hemorrhagic disease, but this observation did not attract the attention of students of nutrition at the time. Later when it had been found by Eijkmann and others that beriberi could be reproduced experimentally in fowls by feeding them upon polished rice, Holst and Frölich undertook to study ship-beriberi in a similar way, using guinea-pigs instead of fowls with the idea that experiments upon a mammal would be more directly applicable to human experience. As is well known, the guinea-pigs on the rice diet developed scurvy instead of beriberi. And scurvy developed in a similar way when either polished or unpolished rice or any other grain was the sole food. This we now attribute to the lack of a necessary antiscorbutic substance (vitamin C) in these grains.

Largely through the work of Cohen and Mendel and Hess and Unger in this country, and of Chick, Hume, Delf and others at the Lister Institute, London, supplemented more recently by investigations at Columbia University, experimental diets have been developed which, while either wholly or practically devoid of vitamin C, are adequate to meet all other nutritive requirements.† By observing with quantitative accuracy and in sufficiently numerous experiments

* For the sake of brevity it has been necessary to omit from this paper the bibliography, the complete description of the method of determining vitamin C as finally developed in the writer's laboratory, and the tables of occurrence of the vitamin in each specific article of food for which reports have been found. These, together with a much fuller discussion of the distribution and properties of vitamin C, have been included in the monograph entitled The Vitamins prepared for the American Chemical Society by H. C. Sherman and S. L. Smith, and published by The Chemical Catalogue Company, New York City, 1922.

† See footnote above.

the effects of such diets with and without the addition of measured amounts of any food which we wish to test for vitamin C, it becomes possible not only to ascertain the presence or absence of this vitamin but also to determine the relative quantities present in different foods, or in the same food before and after any desired treatment. Thus while the instability of this vitamin will probably delay for many years its actual isolation in pure form, yet having learned to measure it by its effects, we are now able to study its distribution and its behavior under various chemical and physical conditions and are thus gaining considerable information regarding its nature and properties through these studies of its occurrence and behavior.

### *Occurrence in Vegetable Materials.*

Mature, resting seeds evidently contain very little if any of this vitamin. In a diet otherwise adequate the amount of grain fed has no appreciable effect upon the appearance or severity of scurvy. But if properly sprouted grain be fed it is found to have pronounced antiscorbutic properties. Evidently in the sprouting of the grain (and this applies to legumes as well as cereals) there occurs a marked development of vitamin C. As nothing but water need enter the seed, it is plain that something pre-existing in the seed must become transformed into vitamin C as the seed sprouts.

This formation of vitamin C in the seed as it passes from the resting stage into a condition of active metabolism is undoubtedly of fundamental significance. From which of the pre-existing substances in the seed the vitamin C is formed, we do not know. It has been suggested that it may be formed from vitamin B but there does not seem to be adequate evidence either to establish or to disprove this suggestion.

Being readily soluble in water, the vitamin C formed in the sprouting seed passes as a constituent of the juice or sap into the growing parts of the plant and in general the studies of the distribution of this vitamin in plant materials, show it to occur most abundantly in the actively functioning and the succulent parts,—in the fresh green leaves, the growing shoots, and the juicy stems, roots, tubers, bulbs and fruits. Thus oranges, lemons, tomatoes and raw cabbage are among the richest sources of vitamin C; apples, carrots and potatoes do not contain such a high concentration of the

vitamin but are important as antiscorbutics because of the extent to which they enter into the dietary. Onions and rhubarb are reported as good antiscorbutics but do not appear to have been studied quantitatively.

Time and space do not permit any attempt to extend these illustrations to a complete list of the reported occurrences of this vitamin in different plant products; nor can many strictly quantitative comparisons be made as yet because of the different basal diets which hitherto have been employed by different experimenters.

Where and when the plant forms its vitamin C, beyond the amount produced in the sprouting of the seed, is not yet determined; but there seems to be no room for doubt that this vitamin is in some way connected with the active life processes of plants as well as animals.

### *Occurrence in Animal Materials.*

Broadly speaking, animals doubtless depend upon plants for their supplies of vitamin C. Whether some species of animals (such as the rat which seems so independent of antiscorbutic food and so immune to scurvy) are able to utilize the inactive form or related substance such as we have referred to as existing in seeds, is still an open question. The fact, however, that rats thrive so well on diets made up almost entirely of highly purified foodstuffs would seem to suggest that their needs for this vitamin are small, rather than merely that they are able to utilize it in a different form from that required by the guinea-pig, the monkey, and man. These species, and doubtless most other animals as well, must have vitamin C as such in their food and cannot store it to any large extent in their bodies. Muscle tissue contains very little vitamin C. There is a somewhat higher concentration in the glandular organs and perhaps also in the blood. Hess suggests that blood may be comparable in this respect with milk, and milk normally contains a much higher concentration of vitamin C than does muscle. According to Hess a pint per day of average milk supplies the antiscorbutic requirement of a child.

Several investigations have shown that the food of the cow has considerable influence upon the antiscorbutic value of her milk. In the work of Dutcher, Eckles, Dahle, Mead and Shaeffer (1920) tests were made upon guinea-pigs to determine quantitatively the

antiscorbutic values of samples of milk obtained from the same cows, first on winter and then on summer feed. They concluded that the summer milk was three times as rich in vitamin C as the winter milk. They report also that when the diet is low in vitamin, the vitamin value of the milk decreases slowly; while when the diet is made rich in vitamin, the vitamin value of the milk rises rapidly. This is in accordance with the view that the body cannot store much vitamin C but does carry a limited store which during lactation gradually passes to the milk in case the amount furnished by the food is subnormal. In other words, a vitamin deficiency during lactation may be expected to be divided between the lactating mother and the suckling young, and both must be expected to suffer as the result of such deficiency even though distinct symptoms of scurvy may not appear. On the other hand, when food rich in vitamin is fed, the body is able to store only a relatively small amount and the surplus entering the body from the food is immediately utilized in the enrichment of the vitamin content of the milk.

These principles doubtless apply as well to the milk of the nursing mother as to cow's milk. The evidence suggests strongly that the general problem of maternal feeding must be conceived in sufficiently broad terms to cover the food intake of the mother as well as that of the child. In order that breast feeding shall actually show the superior results that are normally expected from it, it is important that the food of the mother shall be well chosen. Her diet should contain liberal amounts: (1) of fruits and vegetables with their high content of vitamins B and C; and (2) of milk with its large amount of vitamin A (as well as considerable of vitamins B and C), with its abundant and exceptionally constituted mineral content, and its highly efficient proteins.

This necessarily brief consideration of the distribution of vitamin C in animal matter, leads naturally to the question of its physiological properties and significance.

### *Physiological Properties.*

The recent publication of Hess' excellent monograph on scurvy, with its full account of the pathology of the disease both as encountered clinically in man and as induced experimentally in guinea-pigs, makes it unnecessary to speak here of the scurvy

symptoms which result from the lack of a sufficient amount of vitamin C in the food.

What should perhaps be emphasized is the probability that vitamin C not only prevents scurvy but plays an important part in normal nutrition as well. Thus the rat does not develop scurvy when kept on a "scorbutic" diet such as would induce the disease in man, monkey or guinea-pig; yet we have evidence that the rat is not indifferent to the vitamin C furnished by his food. Harden and Zilva and almost simultaneously Drummond tried the addition of vitamin C in the form of orange juice to the diet of rats and found this to result in better growth and vigor. Further light has been thrown upon this subject by the finding of Parsons in McCollum's laboratory that rats' livers contain vitamin C even after long periods on "scorbutic" diets. It is highly improbable that this can be accidental. All these observations indicate strongly that vitamin C plays a part in the physiology even of those animals which are not subject to scurvy. Similarly in the human body the absence of distinct symptoms of scurvy is not proof that as much vitamin C is being furnished by the food as is needed for the best fulfillment of all the physiological functions. The clinical work of Hess shows how frequent among young children are the cases in which irritability, lack of stamina and retardation of growth can be cured, and better growth and general vigor induced, by the addition of more antiscorbutic food to the diet. Plainly, vitamin C not only prevents scurvy but has positive functions in normal nutrition as well. This makes it practically important to learn the physical and chemical properties of this substance in order that the industrial and household manipulations of food may be adapted to the conservation of this now prominent factor in food value.

### *Physical and Chemical Properties of Vitamin C.*

Vitamin C is freely soluble in water or in alcohol (Hess and Unger), dialyzes through parchment (Holst and Frölich), passes through a porcelain filter and is not adsorbed as is vitamin B by fuller's earth or Lloyd's reagent (Harden and Zilva). Hence the juices of antiscorbutic foods, and the liquor or "water" of such foods when canned, may be expected to contain as high a concentration of the vitamin as does the solid part of the food. In general the proportion lost from food by being dissolved away in cooking or

canning is likely to be fully as great for vitamin C as for vitamin B, and we have no method of recovering vitamin C from its solutions by precipitation or adsorption as vitamin B is precipitated by phosphotungstic acid or adsorbed by Lloyd's reagent.

Vitamin C also differs from vitamin B in being more readily destroyed either by heat or by oxidation. Recently several different investigators have shown independently that vitamin C is readily destroyed by oxidizing agents. In any such case the destruction may be expected to occur more rapidly with rise in temperature. Such drastic oxidizing agents as potassium permanganate and hydrogen peroxid show marked destructive action even at room temperature. In the case of oxidation by contact with air the destruction becomes rapid only on heating. Thus heating is much more destructive of vitamin C in the presence of air than in its absence.

FIG. 1.

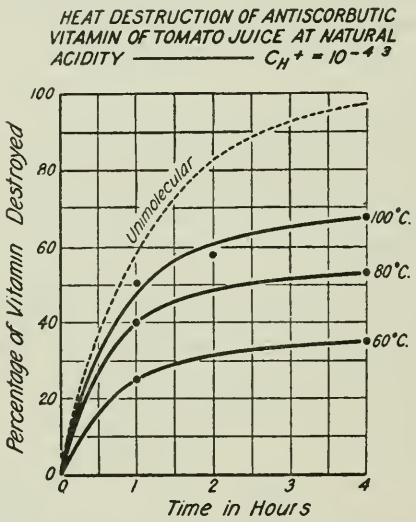



FIG. 1. Time curves showing the progress of the heat destruction of vitamin C in tomato juice of natural acidity of 60°, 80°, and 100° C. The broken line shows how the destruction would proceed if it were a simple unimolecular reaction of the same initial rate at 100° C.

It would, however, be a mistake to conclude, as some seem to do, that the losses of vitamin C which occur for instance in the cooking, canning, or drying of food are always attributable to oxidation and

that heating simply raises the rate of the oxidative destruction. Doubtless oxidation of vitamin C, like other chemical reactions, is more active at higher temperatures; but we must also recognize that heat destruction as such is still an important factor in the case of vitamin C.

The destruction of vitamin C by heating in water solution (as in the juices of the typical antiscorbutic foods) is a process which proceeds at a rate which can be measured experimentally and which has been studied quantitatively with reference to the influence of temperature, time of heating, and the hydrogen ion concentration (acidity or alkalinity) of the solution.

In the case of tomato juice of natural acidity ($pH = 4.3$), it was found by La Mer, Campbell and Sherman that boiling for one hour destroyed practically 50 per cent., and boiling for 4 hours destroyed practically 68 per cent. of the antiscorbutic vitamin. At lower temperatures there was less destruction in a given time. Figure 1 shows the time curves of the heat destruction of the vitamin at 60°, 80°, and 100° C. It will be noted that throughout the entire range of times and temperatures covered by these experiments, the destruction was always greater the higher the temperature whatever the time of heating selected for the comparison, and also that at whatever temperature the material was heated the destruction of the vitamin also became greater the longer the heating was continued.

Thus both time and temperature are important factors in the heat destruction of vitamin C and neither the time nor the temperature can be treated with indifference in any heating operation in which it is desired to conserve the antiscorbutic property of the food. Both time and temperature of heating must be held to the lowest practicable minimum if the antiscorbutic vitamin is to be conserved to the best advantage.

The best conservation of the antiscorbutic value of the food also demands avoidance of the use of soda or other alkali. Not only is vitamin C more readily destroyed in an alkaline than in an acid solution; any decrease of acidity, even though the material may still remain acid, means that a greater percentage of the vitamin will be destroyed under the same conditions of time and temperature. Thus tomato juice which lost 50 per cent. of its vitamin C in one hour at 100° C. at natural acidity, lost 58 per cent. under the same heat treatment when it had been about half neutralized, and about

65 per cent. when it had been made very faintly alkaline (pH = about 9, i. e., at a reaction which would appear "neutral" to the indicator phenolphthalein).

The fact that Hess and also Hume have found the antiscorbutic vitamin to be well preserved in sweetened condensed milk is evidence that vitamin C in a nearly neutral medium can be preserved through a moderate heat treatment and subsequent storage when both heating and exposure to air are reduced to a minimum by evaporating under vacuum and immediately placing the product in airtight containers. In food of higher acidity the antiscorbutic vitamin may be well preserved even without the use of vacuum, as for example in the case of canned tomatoes which are among our best antiscorbutics. Unfortunately, but few quantitative studies of the antiscorbutic values of other preserved fruits and vegetables have been reported.

No attempt has here been made to summarize all the known properties of vitamin C, but rather to confine attention to those properties which, together with its distribution, have most direct bearing upon the problem whether American dietaries under all ordinary conditions and at all times of the year are so rich in this vitamin as to give the best possible results. In my opinion this should not be assumed without further investigation. So many of our staple foods contain little if any of vitamin C that a large share of the population through a considerable part of the year must depend for their supply of this vitamin largely upon food which has been canned, dried, or otherwise preserved.

From what has already been said it is plain that we should not be justified in generalizing broadly as to the adequacy of preserved foods as sources of vitamin C, for this will depend upon several factors which vary greatly in different foods. The amount of vitamin C which the food contains at the beginning; its hydrogen ion concentration; the time and temperature of heating to which it is subjected; the extent to which, and temperature at which, it is exposed to air; possibly also the presence or absence of substances which may catalyze the oxidation or heat destruction of the vitamin;—all these are factors which may influence the antiscorbutic value of a preserved food, and there may be other factors not yet recognized. The matter is both too important and too complicated to be left to inference. Careful determinations should be made of the antiscorbutic values of all the chief types of food as influenced by different methods of preparation and preservation.

# THE RELATION OF THE DIET TO RICKETS.

P. G. SHIPLEY, M.D.

*Baltimore, Md.*

In the latter half of the 18th century the planters of the West Indies and the Carolinas were conducting nutrition experiments on a large scale with human beings as subjects, and with the object of ascertaining how cheaply they could maintain their slaves in good health and vigor. They succeeded in convincing themselves that negroes could not be fed on white rice alone, because on such a diet they developed "dropsy" or "sore eyes." The soreness of the eyes which attacked the unfortunate slaves on the Carolina plantations would now be called xerophthalmia, and associated with a deficiency of the vitamin, fat-soluble A. This disease is rarely seen among adults in this country now, but is not uncommon as a part of the condition which has been described as Mehlnahrschaden in children. In the Orient and those parts of the world where the population is liable to long periods of food shortage it is by no means rare. It is characterized by photophobia, hemeralopia, and dryness of the conjuctiva. As the disease progresses keratomalacia and iritis develop, with hypopion, destruction of the cornea, and panophthalmitis. Xerophthalmia, which is after all only the local exaggeration of general malnutrition, is one of the triad of deficiency diseases, of which the other members are scurvy and nutritional polyneuritis. It may be that an insufficient intake of the fat-soluble vitamin is responsible, jointly with other dietary maladjustments, for many physical derangements and nervous disorders, but keratomalacia is at present the only pathological condition aside from osteoporosis which has been shown to depend upon a deficiency of this vitamin alone. It is difficult at the present time to unite any single nutritional factor with specific pathological results in the human body, especially since states of malnutrition in man are almost never due to a single deficiency. Except in times of siege or famine human beings do not usually suffer from complete starvation for

any one element. Insufficiency is far more common than total deprivation. Moreover, it would seem as though the need for the vitamins, and the result of their absence from the diet, is to a certain extent dependent on the amount of other factors present in the food and their quantitative relation to one another. However, an insufficient intake of the fat-soluble A has been suggested by some investigators as playing a part in the production of such pathological states as intestinal infantilism, coeliac disease, nutritional edema, wet beriberi, and the occurrence of phosphate concretions in the bladder. It has recently been stated that rickets is caused by deficiency of fat-soluble A, or some substance having a like distribution. Rickets is not a deficiency disease, as the term is commonly understood.

It is necessary to stop a moment here to discuss rickets as it occurs in children. In the first place, we must appreciate the fact that while visible pathological manifestations of rickets are largely confined to the skeleton, the disease involves the whole organism. There can be no other interpretation of the loss of muscle tone, the profuse head sweats, the gastro-intestinal disorders, and the apathy or fretfulness of the rachitic child. The pathology of the bone I shall not discuss here. But the pathology of the blood is not so well recognized and deserves attention. Howland and Kramer found that the calcium in the blood serum of the children averages 9 to 11 milligrams per hundred cc.; the phosphate of the serum averages 4-6 milligrams per hundred cc. Children with rickets as it is ordinarily seen show little if any reduction of the amount of calcium in the blood, but the phosphate, on the contrary, may be reduced as low as 1 milligram per 100 cc. Children may be seen with rickets, however, whose blood serum shows a marked reduction in the serum calcium, the serum phosphate remaining at or about the normal level. If the serum calcium of these children is below 5 milligrams per 100 cc., the rickets is complicated by manifest tetany. We say that latent tetany is present if actual manifestations of tetany are not found in a rachitic child with a low serum calcium. Healing of rickets is accompanied by the restoration on the one hand of the normal phosphate level, on the other, of the normal calcium content of the serum. Now, when rats are fed on diets of purified foodstuffs it is possible, when an uncharacterized organic substance which is contained in certain fats is insufficiently supplied, to induce rachitic changes in the skeleton in either one of two ways. The diet may

be low in phosphorus but high in calcium, or may contain an approximately normal amount of phosphorus and be low in calcium. In other words, there is a level on either side of a normal calcium-phosphate balance at which a pathogenic calcium-phosphate ratio in the diet may result in rachitic changes in the bone. In the rat then there are two kinds of rickets, one of which results from a diet *caeteris paribus* low in phosphorus, one which follows the administration of a diet *caeteris paribus* low in calcium. It would seem as though this same thing might be true of children. It is necessary to use the phase "caeteris paribus" in describing a deficiency of calcium or phosphate, since the production of normal bone depends on the maintenance of a normal ratio between the two ions, not on the absolute amount of either in the food. The fact that a perfectly normal bone may be produced on diets which are low either in calcium or phosphorus, providing that the level of the other ion is proportionately depressed, shows that the rachitic lesion is really dependent on the ratio of calcium to phosphorus. There is an optimal level, however, for both ions, and when the balance in the diet is maintained at this point the optimal growth of the animal is assured, providing all other factors of a complete diet are sufficiently supplied. Below this point the salt content of the food may become to some extent a limiting factor as far as growth is concerned. The optimal amount of calcium which the diet can furnish for growth, maintenance and function in the rat has been shown to be 0.641 grams per 100 grams of ration, all other factors of the diet being satisfactory. The amount of phosphate has not been so well worked out, but it is about 0.4936 grams per 100 grams of food. A diet containing 0.832 grams of calcium and 0.305 grams of phosphate produces a lesion which exactly corresponds to the severest form of rickets seen in children. Such an animal will have 10 milligrams of serum calcium per 100 cc. A normal rat will have 10 milligrams per 100 cc. The blood phosphate for a rachitic animal of this, the low phosphate type, will be 2.5-3 milligrams per 100 cc., that of a normal rat will be 8 milligrams per 100 cc. If now an animal is fed on a diet in which the calcium is reduced to 0.052 grams per 100 grams of ration, the phosphorus being 0.364 grams, a lesion also results which presents all the essential characteristics of rickets. The blood of such an animal will contain 4.5 milligrams of calcium and 8-9 milligrams of phosphorus.

We have now to consider the rôle of fats in rickets. In May

of 1921 we published an article which showed that a deficiency of fat-soluble A does not produce rickets, providing the required salt balance is maintained in the food. This has been since confirmed by numerous investigators. A deficiency in this vitamin is followed by a cessation of growth and a condition of osteoporosis develops. There is, however, a substance present in cod liver oil, and to some extent in butter fat, which enables an animal to compensate for a faulty calcium-phosphate ratio in the food. This substance is distinct from fat-soluble A. This uncharacterized organic substance is present according to Zucker in the unsaponifiable fraction of cod liver oil. It is present in butter fat as well as in cod liver oil but to a much lesser extent. Thirty per cent. of butter fat is not equivalent to 2% of the diet in cod liver oil. Two per cent. of cod liver oil will prevent the development of rickets on a rickets-producing diet, and in 5 days will cause visible signs of healing to appear in the bones of a rachitic rat. It will cause healing of the low calcium, as well as of low phosphate rickets. In the low phosphate form of rickets the administration of 2% of cod liver oil for 15 days causes the phosphate in the serum to rise from 3 milligrams to 5 milligrams per 100 cc. Howland and Kramer, who have made the serum analyses the results of which I have quoted, have shown that exactly analogous changes occur in the blood of children under analogous conditions.

Another influence which enables the organism to compensate for unfavorable calcium-phosphate ratios is light from the sun or the mercury vapor lamp. Huldschinsky was able to demonstrate healing in the bones of rachitic children after radiation with the mercury vapor lamp, and we have found that radiation with sunlight, the mercury vapor lamp, or the Fe-Cr, or Cd arcs, prevents the development of rickets in rats although they are maintained on diets which would cause rickets to develop without fail without the influence of radiation. Such radiation will induce healing in rachitic animals without change in the diet, and will cause the same changes to occur in the salts of the blood serum which follow cod liver oil therapy. Radiated animals which have been treated with the light of the Cd arc under the same conditions as those which obtained in treating others with the Fe-Cr arc and the mercury vapor lamp show more advanced healing than the other groups. Filtering the light through window glass removes the protective rays. These facts would make it seem as though the beneficial rays were of the shorter length of

ultraviolet rays. It seems to us that the biological significance of the demonstration of the effect of light on the metabolic processes to the extent of causing or preventing structural alterations is of the greatest importance from the hygienic standpoint. Consideration of natural illumination must in the future modify the dietary of miners, convicts, and those who from necessity or ignorance are deprived of light. Individuals who are exposed to full daylight can get on normally with the diet which in the absence of radiation would be extremely defective. Light, though it protects against and cures rickets, has no demonstrable influence on the appearance of xerophthalmia.

The last consideration which modifies the result of a rickets-producing diet is starvation. Starvation will precipitate an extraordinary degree of healing in a rachitic animal in three days. This healing is accompanied by a marked rise in the blood phosphate. The possibility suggests itself that this might be the result of the restoration of a normal calcium-phosphate balance when the body is left to draw its supplies of these ions from its own tissues. But this is not the case. The phosphate of the blood rises from the rachitic level of 3 to 12 milligrams per 100 cc., which is double the amount of the normal blood phosphate. This may be the result of tissue destruction and the release of phosphate from disintegrated muscle tissue. We cannot say now.

To sum up, rickets is a disease of metabolism usually due to faulty food. It may be produced in rats by certain diets containing an improper balance between calcium and phosphorus when an uncharacterized substance associated with certain fats is absent or deficiently supplied. There are two sorts of rickets in rats, one a low calcium type, produced by diets relatively low in calcium, but containing an approximately normal amount of phosphorus, other things being equal, and second, a low phosphate type, produced by diets deficient in phosphorus, with a normal or high calcium content. Some uncharacterized organic substance, which is present in abundance in cod liver oil, enables the organism to compensate for a defective calcium-phosphate ratio in the food. Exposure to sunlight or to the rays of the mercury vapor quartz lamp or of certain metallic arcs will do the same thing. Either of these factors will induce healing in the bones of rachitic animals. Starvation also will induce healing.

These investigations so far leave a great many questions still unsettled. Some of these besides those I have discussed we are in

a position to answer, others await further study for their elucidation. We cannot tell, for example, whether the gastro-intestinal tract receives these diets which we put into it and passes them on to the body without changing their composition. Nor are we now in a position to say whether or not the diets influence the body tissue directly or through some unknown mechanism.

# THE RELATION OF DIET TO PELLAGRA.

JOSEPH GOLDBERGER, M.D.

*Surgeon, U. S. Public Health Service, Washington, D. C.*

It is proposed in the present communication to review the more outstanding, significant evidence bearing on the relation of diet to pellagra including the essential dietary factor on which the relationship found to exist probably primarily depends.

It will be convenient to study this relation by considering the part diet plays in treatment, in prevention and in causation.

*Diet in treatment.*—Opinions of authorities with respect to the place of diet in the treatment of pellagra have differed considerably. Over half a century ago Roussel,[1] on the basis of his own observations and the experience of others, assigned to diet, and particularly to a milk diet, the place of first importance. This high position it seems subsequently not to have been able to hold, in large measure, at least, by reason of the dominating influence of Lombroso's teaching.

Lombroso[2] recognized that a liberal diet, particularly one of meat, was valuable in pellagra, but having arrived at the conviction that pellagra was due not to insufficient alimentation but to an intoxication he labored to find a pharmacological antidote and thought that he had succeeded in finding such in arsenic. His views having been accepted by the foremost Roumanian clinicians, arsenic (particularly Fowler's solution) enjoyed a high repute among European observers.

When Americans came to deal with this problem their experience proved to be disappointing so that a search for a better remedy was taken up by them and soon, in rapid succession, a number were suggested and earnestly advocated. At the same time not much attention was paid to diet which, with rare exceptions, received at most only incidental mention, being considered on a par with baths, change of climate, etc., attention being especially focussed on one favorite remedy or another as the prime element in the "treatment" advocated. So much did this come to be the case that when in 1914 diet was urged by us[3] as the rational treatment and it was pointed out that there was no medicine known that had any proved specific value,

the suggestion was received as decidedly heterodox and, in some quarters, with vigorous dissent.

The results of a number of studies[4, 11] including observations of our own, made since then, all go to show that in uncomplicated cases of average severity the administration of a diet rich in animal protein foods (milk and meat) is quite regularly followed by clinical improvement which begins to be manifest in about ten days to two weeks. With only rare exceptions, provided the patient coöperates fully in taking the diet, the improvement thus begun continues progressively to eventual, complete, clinical recovery. Should the coöperation be unsatisfactory or the diet be inadequate either because suitable additions to the prepellagrous diet have not been made, or not made in sufficient quantities for the needs of the individual, a very different picture results. In these circumstances the manifestations either remain stationary, the symptoms continuing without significant change, or they develop further and with increasing severity. But even in such more advanced cases a favorable change in food intake may be followed by improvement and recovery. Should such change, however, not soon be effected the further progress and outcome of the case are of the gravest character.

The foregoing would seem very clearly to indicate that diet operates as a dominating factor in controlling the clinical course and outcome of the attack. But in order justly to appraise the importance of this apparently dominant influence of diet, it will be necessary to consider, even though briefly, whether, and how, there can be harmonized with it certain seemingly discordant observations, namely, first, the failure of diet in certain cases to control the course and outcome of the disease, second, the clinical improvement following correction of a concomitant disease or condition of an exhausting character without change in diet, and, third, the normal progress of the attack towards recovery without regard to treatment.

With respect to the failure of diet in certain cases of pellagra it should first of all be made clear that this means simply that the progress of some cases is unfavorable and that they die in the attack in spite, seemingly, of the most careful feeding. In our experience the number of the cases that properly fall in this class has been relatively very small and almost invariably these were manifestly very severe, frequently neglected cases when they first came under observation. That some such should die would seem to be no more

than may reasonably be expected particularly when it is recalled that a certain mortality occurs in human beriberi under analogous conditions.[5]

It has been repeatedly observed that the elimination of a concomitant disease or condition of an exhausting nature, such, for instance, as hookworm infestation or physical strain, may be followed by clinical improvement without any change in diet. In considering this interesting phenomenon it is to be remembered that the adequacy of a diet is not necessarily an absolute quality but one that may depend on a number of variables some of which are connected with the individual himself. Thus a diet that falls short of supplying the needs of the individual who is suffering from a drain such as that imposed by infestation with the hookworm, the blood fluke or the dysenteric ameba, may adequately supply the needs of the individual not so taxed; or, again, a diet that is insufficient for the woman who is up and about attending to her housework may fully supply her physiological requirements after she takes to her bed. The explanation that suggests itself, therefore, is that the elimination of an exhausting disease or condition, by making available nutrients that previously were, in one way or another, diverted from or lost to the body or by reducing the physiological requirements connected with lessened energy needs, raises the relative nutritive value of the diet without any actual change therein being made.

It is an interesting and a very striking epidemiological fact that, in general, in an endemic locality, cases of the disease begin to appear in March or April, become increasingly numerous during May, reach a peak in June, then rapidly fade and disappear so that few are recognizable in September and, perhaps, not a single one may be discoverable in October where dozens may have been seen in June. Now while some of the more severe of these may have sought and received professional advice and treatment, most, if not all, of the others ran their course not only without any treatment but many without the existence of an abnormal condition being recognized by the individual or the individual's family. Here then we seem to have an indication of the natural, undisturbed course of an attack; does not this suggest that its normal progress is towards recovery independent of diet, and for that matter, of other treatment?

So far as independence of any medicinal treatment is concerned, this question may, it seems clear, be answered definitely in the

affirmative. As it applies to diet, however, it is necessary first to determine whether the implied assumption that no dietary modification was made by the individuals who neither sought nor received treatment and, particularly, by those in whom the existence of the disease was not even suspected, is warranted.

That this assumption is not warranted quickly appears when it is recalled that the availability of supply of certain classes of foods, even for those living in places large enough to enjoy the benefits of cold storage, varies in some degree from season to season, and that in smaller or rural localities, depending very largely or entirely on local production for a supply of certain (perishable) foods, the variation in seasonal availability of these is even more marked. That such variations in availability tend to influence the diet of the household, and thus of the individual, every thoughtful person will recognize from his own experience. It follows, therefore, that in seeking to explain the seasonal incidence of the disease and the course normally pursued by an attack, account must be taken of the seasonal variation in food supply as, at least, a possible factor.

It thus appears that none of these seemingly discordant observations is inconsistent with the indication that diet operates as a dominating factor in controlling the clinical course of the attack.

*Diet in prevention.*—In the past, pellagra has almost invariably been regarded as a chronic disease with a course marked by more or less regular, annually-recurring attacks extending over an indefinite number of years.

There are not lacking in the older literature observations which suggest that this conception might not be sound. Thus Cerri in 1795 (cited by Roussel,[1] 1866, p. 466), in an investigation of the cause of pellagra, is said to have fed ten well-marked pellagrins with "good food" in part of animal origin and with "good bread" instead of the cornbread and polenta with which they had previously nourished themselves, and to have observed that their condition rapidly improved and that in the following year neither the eruption nor other manifestations made their appearance. A number of somewhat similar individual observations were made by Strambio[12] who interpreted them simply as showing that a better diet masked the disease. Strambio's idea may be said to be summed up in the sinister aphorism that "once a pellagrin always a pellagrin." This seems to have profoundly influenced medical opinion practically to the present day.

Such at all events was authoritative opinion in 1915 when Goldberger, Waring and Willets[3a] reported that following modifications in the diet of the inmates of two orphanages which for several years had been endemic foci of pellagra, only one recurrence was observed among an aggregate of 172 pellagrous children who had been under observation until at least the anniversary date of the previous attack, and not a single case among an aggregate of 168 non-pellagrin residents all of whom had been under observation at least one year, and, further, that following modifications in the diet of two groups of pellagrous insane of the Georgia State Sanitarium, also an endemic focus of long standing, not one of the 72 individuals constituting these two groups developed any evidence of a return of the disease. They concluded that pellagra may be prevented by an appropriate diet without other alteration in hygiene or environment (including water supply).

These findings have since been confirmed by other workers. White,[6] studying an outbreak of pellagra among Armenian refugees at Port Said in 1916-1917, concludes, among other things, that "pellagra was eradicated from the (refugee) camp by correcting the faulty dietary, all other conditions remaining the same." Similarly, Stannus[7] reports that following improvement in the dietary, pellagra disappeared from among the inmates of Central Prison, Nyasaland, where "excepting the change in diet all other conditions remained the same." And Wheeler,[8] working at Spartanburg, S. C., found that "one supplemental meal of fresh meat, milk, vegetables, fruit, bread (either white bread or cornbread) and butter was adequate to relieve the symptoms and to prevent recurrence in cases of pellagra of moderate severity in patients continuing in the environment in which the disease had originally developed or had previously recurred."

It may be added that the results of the further studies (unpublished) of prevention carried on by the workers of the Public Health Service during a considerable additional period and extended to include a larger number of pellagrous insane and a third orphanage in which the disease had prevailed extensively, are in harmony with, and fully confirm, the results of the first year's study reported on in 1915. Without exception, following changes in diet, other conditions remaining the same including the admission of fresh cases from without, both recurrences and new cases ceased to develop. One would seem warranted in concluding, therefore, that not only does

diet control the course of the immediate attack, but that the clinical recovery thus brought about continues and no new cases develop so long as a proper diet is maintained.

Before this conclusion can be accepted as valid, however, it will be necessary to determine the significance of certain observations which seem, in a measure at least, to negative such conclusion. These observations deal with cases which, in a general way, fall into one of three categories.

Embraced in the first of these categories, are those relatively very rare cases occurring in well-to-do individuals. Here the favorable economic status is assumed to indicate not only that a "good" diet was available but also that it was consumed and therefore, it is reasoned, pellagra occurred in spite of a "good" diet. While under the circumstances, the assumption that a "good" diet was available is, in general, a reasonable one, it does not follow and, since it is the crucial point, it clearly is not permissible to assume that the diet actually consumed was "good" and adequate for the needs of the particular individual concerned. Quite aside from the serious difficulty (if not impossibility) of deciding in a particular instance, on a mere qualitative statement, whether the available ration is actually adequate, such assumption ignores individual likes and dislikes with respect to certain foods or dishes which may operate markedly to modify the make-up of the individual diet.[9]

In the second category are the cases in individuals who are alleged to have consumed a "good" diet either because a statement of the diet of the household of which the individual was a member was interpreted by the observer as adequate, or because the official ration of the dietary group (institution or camp) to which the individual belonged was believed to be satisfactory. Evidently here too the possibility of individual eccentricity of taste operating as a factor determining the make-up of the diet consumed, is ignored. Nor is the vitally important possibility of error in the statement of the composition of the household diet or of a wide divergence between the official ration table and the ration as it reaches the individual, sufficiently considered. A very interesting and instructive illustration of the serious error to which failure to properly consider and exclude such possibilities may lead and the perplexity to which it may give rise, is to be found in Enright's[10] report of an outbreak of pellagra among some German prisoners of war in Egypt.

After presenting the details of the outbreak Enright concludes, in part as follows: "A critical analysis of the diet which these German pellagrins ate before capture and during their period of captivity prior to the onset of the eruption is sufficient to explode the food-deficiency theory as a predisposing factor. These diets were ample, both in quantity and quality, for any possible requirements, and were of such varied composition that it is perplexing to understand how they could be improved."

So far as we are aware this report, by reason of the presentation of details that are almost invariably lacking in reports of individual cases, is among the most impressive instances in the literature of the apparent failure of diet to prevent pellagra. Yet the discussion (Lancet, London, 1920, vol. 2) evoked by it and the independent official investigation by Hammond-Searle and Stevenson[11] developed facts which clearly show that Enright's conclusion was not well founded, evidence being adduced which indicates that the diet actually consumed by some of the prisoners was not of the high quality (absolutely or relatively) Enright had believed himself justified in assuming it to be.

We come finally to the cases of the third category, namely, those extremely rare and very interesting ones occurring in breast-fed infants. Here the explanation sought is why the breast milk, forming as it did a very large part if not the whole of the diet, failed to prevent the development of the disease. Voegtlin and Harris[12] have suggested the possibility that the mother's milk in such cases is deficient in vitamines and that this deficiency may be the responsible factor. Although more recent observations indicate, as will presently be seen, that the known vitamines are not essential pellagra preventive elements, it is not absolutely excluded, though highly improbable, that some as yet unknown dietary factor, conceivably a vitamine, plays this rôle. In the light of present knowledge it seems more probable, however, that these very exceptional cases develop primarily because of a defect in the protein (amino-acid) factor arising possibly from (*a*) too low a plane of intake of the milk proteins resulting from a scanty supply of the breast milk, (*b*) a defective utilization of the protein ingested or (*c*) from some combination of these. In this connection mention may also be made, as a very remote possibility, that in these rare instances the protein mixture of the mother's milk may itself be faulty. Thus none of the observa-

tions of the categories considered can be accepted as negativing the conclusion that neither recurrent nor new cases of pellagra develop so long as a diet adequate for the needs of the individual is maintained.

At this juncture the question may be asked whether the disease can be prevented otherwise than by diet. The claim has been made (and by Sambon[13] disputed) that a considerable reduction in prevalence has resulted in Italy from the prophylactic measures based on the spoiled corn theory. Since these measures concern themselves fundamentally with diet, this calls for no discussion in the present connection. Nor, for obvious reasons, need we be detained by the suggestion based on the water theory of Alessandrini and Scala.[20]

Other than these there is but one claim of sufficient importance to warrant any consideration at this time. This is that pellagra may be prevented by improved sanitation, particularly with respect to the disposal of human wastes. The fact that the disease is frequently associated with bad sanitary conditions and, more particularly, the report[14] of an apparently successful experiment to control the spread of the disease at Spartan Mills, Spartanburg, S. C., by replacing an insanitary system of surface privies with a water carriage system of sewage disposal, would seem to support this view.

With respect to the association of the disease with bad sanitary conditions we have in our own studies failed to find a consistent correlation between them; our results indicate that the observed association may be explained as an expression of the well-recognized relation of the disease to the condition of poverty. As for the Spartan Mills experiment, we[15] have elsewhere already reported that our observations in the same locality in 1917 and 1918 (three years after the experiment was begun) showed the disease to be at least as prevalent in this village with its excellent sewerage system as in some other nearby villages with but the crudest, most insanitary methods of sewage disposal, thus clearly proving the failure of an excellent water carriage sewerage system to perceptibly control the prevalence of the disease. In this connection it may be remarked that while additional evidence of the failure of improved sanitary conditions perceptibly to control the occurrence of the disease could be cited, we know of not a single instance of a reduction in pellagra incidence that can properly be credited to the influence of improved sanitation.

Thus in the light of the foregoing discussion the conclusion would seem justified that pellagra may be completely prevented by diet without the intervention of any other factor hygienic or environmental.

*Diet in causation.*—The idea that diet had a relation to the production of pellagra has, in one form or another, been held by the vast majority of the students of the disease beginning with Casal himself. The evidence from time to time adduced in support of the shifting theories of this relationship was all of it indirect until 1915. In that year Goldberger and Wheeler[15] reported the experimental production of pellagra in the human subject as the result of feeding with a diet resembling that which in previous observations they had found to be associated with a high incidence of the disease. The subjects were all healthy, white, adult male convicts who volunteered for the experiment; the controls were the other residents of the penitentiary, 120 in all, of whom 47 were under observation throughout the experimental period. While all of the controls remained free of any recognizable evidence of the disease, not less than 6 of the volunteers developed manifestations recognized by experienced consultants as those of pellagra.

In marked contrast with the outcome of this feeding experiment are the results of the attempts made by a number of observers to communicate the disease from the sick to the well by the inoculation of blood, bodily discharges and the like; these attempts have in all reported instances failed.[16] Nor is there any other evidence of an unequivocal character in support of the idea that the disease may be induced by any means other than diet.

It appears, therefore, that in causation, just as in treatment and prevention, the evidence points to diet as the controlling factor.

*Essential controlling dietary factor.*—The question now naturally arises as to what the essential dietary factor or factors are to which diet owes its power. Several important contributions bearing on this question have been made. The older (Marzari, Lussana and Frua, Calmarza), while in many instances very interesting and suggestive, are, as might be expected, unconvincing and must be passed over; of the more recent only those most pertinent can be considered.

In 1912 Funk provisionally included pellagra in a group of "deficiency diseases," all of which, he stated, could be prevented and

cured by the addition to the diet of certain preventive substances called by him "vitamines." More recently Wilson,[17] studying diets known to have been connected with pellagra and comparing them with those of known value in curing and preventing the disease, has been led to conclude that the etiological factor is a deficiency of protein, best determined by estimating its biological value by means of Thomas's ratings.

Wilson's main conclusion is in agreement with the indications afforded by the results of our own studies[18] of the past four or five years. Of particular interest in the present connection is our[19] recent observation of the failure of what seemed to be a liberal intake of minerals and known vitamins (including the antirachitic factor) to prevent the recurrence of pellagra in five individuals, thus definitely excluding these elements as essential factors in relation to the disease. This observation suggests that of the dietary essentials at present known (and assuming that all are known) the protein factor alone was concerned in the failure to prevent the disease in those cases and, thus, that the dominating rôle of diet in the prevention and causation of pellagra is referable, primarily, to the character of the protein supply. Since the distinctive clinical physiognomy of the disease precludes the assumption of any but specific etiology, in the sense elsewhere suggested, and since protein is now regarded as but a complex of amino-acids, different for different proteins, the dominating rôle of diet in the development of the disease would seem referable to a specific quality of the amino-acid make-up of the protein supply. Just what amino-acid combination, or (within certain limits) combinations of amino-acids are primarily concerned remains for future study to determine. It should perhaps be noted that, as already suggested, the possibility of an as yet unknown factor (conceivably a vitamin) alone or in combination with the amino-acid factor, is not absolutely excluded.

*Conclusions.*—In closing there may be summarized the conclusions developed in our discussion. Briefly stated they are as follows: Diet controls the course and development of the disease. The relationship thus disclosed probably depends primarily on a specific quality of the amino-acid make-up of the protein supply.

## References.


1 Roussel: Traité de la pellagre et des pseudo-pellagres. Paris, 1866.

2 Lombroso: Die Lehre von der pellagra. Berlin, 1898, pp. 166-167.

3 Goldberger, Waring and Willets: U. S. Public Health Reports, Washington, D. C., Oct. 23, 1914, vol. 29, pp. 2821-2825.

3a Goldberger, Waring and Willets: U. S. Public Health Reports, Washington, D. C., Oct. 22, 1915, vol. 30, pp. 3117-3131.

4 Willets: Southern Med. Jour., 1915, vol. 8, p. 1044. Ridlon: U. S. Public Health Reports, Washington, D. C., 1916, vol. 31, p. 1979. Voegtlin: U. S. Public Health Reports, Washington, D. C., 1920, vol. 35, pp. 1435-1452. Bigland: Lancet, London, 1920, vol. 1, p. 950. Goldberger and Tanner: Unpublished data.

5 Vedder: Arch. Int. Med., Aug., 1916, vol. 18, p. 146.

6 White: Report on an outbreak of pellagra amongst Armenian refugees at Port Said 1916-17. Cairo, Egypt. 1919.

7 Stannus: Trans. Roy. Soc. Trop. Med. and Hyg., 1920, p. 16.

8 Wheeler: Jour. Am. Med. Ass'n. 1922, vol. 78, p. 957.

9 Goldberger, Wheeler and Sydenstricker: U. S. Public Health Reports, Washington, D. C., 1920, vol. 35, p. 2709. Roberts: Jour. Am. Med. Ass'n., 1920, vol. 75, p. 21; Tanner and Echols: Jour. Am. Med. Ass'n., 1921, vol. 76, p. 1337.

10 Enright: Lancet, London, 1920, vol. 1, p. 998.

11 Hammond-Searle and Stevenson: Report of Investigations of pellagra among Turkish prisoners of war in Egypt, 1920.

12 Voegtlin and Harris: Hygienic Laboratory, Bull. No. 116, Washington, D. C., 1920.

13 Sambon: Progress report on the investigation of pellagra; Jour. Trop. Med. and Hyg., 1910.

14 Siler, Garrison and MacNeal: Arch. Int. Med., 1917, vol. 19, pp. 683-694.

15 Goldberger and Wheeler: Hygienic Laboratory Bull. No. 120, Washington, D. C., 1920.

16 Buniva, cited by Roussel (1), De Rolandis, cited by Roussel (1). Calmarza: Memoria sobre la pellagra; Madrid, 1870. McCafferty: Gulf States Jour. of Med. and Surg., etc., 1909, pp. 228-236. Goldberger: U. S. Public Health Reports, Washington, D. C., 1916, vol. 31, pp. 3159-3173.

17 Wilson: Jour. Hygiene, 1921, vol. 20, pp. 1-59.

18 Goldberger, Wheeler and Sydenstricker: Jour. Am. Med. Ass'n., 1918, vol. 71, pp. 944-949. U. S. Public Health Reports, Washington, D. C., 1920, vol. 35, pp. 648-713.

19 Goldberger and Tanner: U. S. Public Health Reports, Washington, D. C., 1922, vol. 37, pp. 462-486.

20 Alessandrini and Scala: Contributo nuovo alla etiologia e patogenesi della pellagra, Roma, 1914.

# THE APPLICATION IN PRACTICE OF THE RESULTS OF VITAMIN STUDIES.

L. EMMETT HOLT, M.D., LL.D.

*New York.*

Our knowledge of vitamins has given a new basis for the evaluation of foods. Certain articles which from the point of view of their energy value are almost worthless have been shown to possess a nutritive value which is very great. Their importance is not suggested by their chemical analysis. They furnish something very essential in a human diet.

The tomato, cabbage, spinach, lettuce, chard and all the green or leafy vegetables are composed chiefly of cellulose, water and inorganic salts. Fruits have sugar, vegetable acids, water and salts, but none of these things suggest their essential value as foodstuffs.

Many of our foods we no longer eat in their natural state. The conditions of modern life have made necessary the transportation of foods for long distances and the preservation and storage of food in immense quantities for long periods, as a normal food reserve. A certain amount of injury is done to our vegetables, fruits, milk, meats and grain by the processes to which they are subjected in preparation, preservation and storage. The study of vitamins has helped us to understand, to some degree at least, the nature of that injury. Some of it is due to the heat applied during our ordinary processes of cooking; some is a consequence of heat applied for purposes of sterilization, whether for the destruction of the germs of disease or for the preservation of food.

We have also sacrificed something in their nutritive value by the refinement of our foods, as in polishing rice and using only the white flour of our wheat to make our bread and feeding to pigs and cows the balance of the grain. The coarse black bread of the Middle Ages and of the European peasant of to-day is despised by our modern civilized city dweller.

But let us not at the same time forget the immense benefits of the preservation and storage of food. Take for example the question of white wheat flour. As long as wheat was grown and milled here, as it still is in most European countries, within a com-

paratively short distance of where it was consumed and was used within a few weeks of milling, the problem was a simple one. At present much of our milling is done one or two thousand miles from our large centers of population. Not only must the time required for transportation be taken into account, but the necessity for storage of immense quantities as a normal food reserve. New York City, for instance, consumes over 20,000 barrels of flour every day. Very much of this, it is estimated, has been milled five or six months before it is eaten. White wheat flour keeps indefinitely, certainly for many months, without any important deterioration. But whole wheat flour can be kept only about thirty days; after that it is likely to become "wormy." Flour experts tell us that the general adoption of whole wheat flour for bread in this country is an economic impossibility. The modern method of milling and our system of transportation and storage make a bread famine here almost impossible.

Although heating milk may injure or destroy its vitamin C, this fact does not invalidate its great advantages, such as protection from diseases which may be communicated through milk and its preservation by drying, condensing or sterilizing which permits its wider use as a food all over the world. The same may be said of the canning and drying of vegetables, fruits and eggs. These preserved foods are all of great benefit in the nutrition both of children and adults. We would not stop the use of them if we could.

Our knowledge of vitamins has however pointed out that these procedures have their disadvantages, even their dangers; but when the nature of these is once thoroughly understood and their importance appreciated, the remedy will come also.

In the food of infants it is only vitamin C that is likely to be injured by any process to which their food, chiefly their milk, is subjected in preparation or preservation. In the first place it should be understood that the amount of this vitamin in milk is small. Chick and Hume found that to protect a guinea-pig, whose food contains no other source of this vitamin, 100 cc. daily of fresh milk are required, although complete protection is secured by only 1.5 cc. of orange juice.

It is well established that all heating of milk (I do not of course mean warming for feeding) whether by boiling, pasteurizing, sterilizing, drying or condensing, injures this vitamin. It has not been shown that vitamin A or vitamin B in milk is thus injured. The amount of

injury done to vitamin C depends upon the height of the temperature and the length of the period during which the temperature is maintained, and possibly upon whether the heating is done in open or sealed vessels. The duration of the heating seems clearly quite as important as the temperature employed. Short heating at a high temperature apparently does less injury than prolonged heating at a lower temperature; so far as its effect on this vitamin is concerned, boiling for five minutes seems better than pasteurizing for thirty minutes.

While there is still some difference of opinion among investigators as to the relative amount of damage done by various types of heating, it may be regarded as proven that they all injure milk in this respect, and that the only safe rule in practice is to supply some efficient antiscorbutic in the diet of all infants reared upon milk treated in any one of these ways.

Evidently the body has a sufficient store of this vitamin to meet its needs for a considerable time, for symptoms of scurvy do not usually appear for some months after the deficient diet has been taken. Of the last nine cases of infantile scurvy treated in my hospital service the period was between five and seven months in seven and in none more than nine months.

Of course one cannot be certain that the diet contained no vitamin C whatever, as the food was in most cases pasteurized or sterilized milk. If the food contains even a small amount of antiscorbutic vitamin the development of scurvy will be delayed. To infants whose principal or sole food is any one of the forms of heated, dried, or condensed milk it would appear then to be quite sufficient if an antiscorbutic were begun at the age of five months.

The observations of Hart, Steenbock, Ellis and others indicate that the vitamin content of cow's milk is affected by the food of the animal. This was first shown to be true of vitamin C. The winter milk of stall-fed animals was decidedly poorer in this respect than the summer milk of pastured animals. This same law seems to hold with respect to all the vitamins. If the food of the cow does not contain an adequate supply, the milk may be deficient in any or in all of them. It would seem, therefore, a wise precaution during the winter to supplement cow's milk by other foods known to be rich in vitamin A, such as butter, the yolk of egg or the juice of steamed green vegetables, but best of all by cod liver oil.

The vitamin content of the food of the nursing mother undoubtedly affects her milk in a similar way. This may furnish a clue to some of the puzzling cases of scurvy developing in nursing infants.

It is reported that among the Filipinos beriberi is common among the nursing children of rice-eating mothers of those islands. This is believed to be a large factor in the extremely high infant mortality which is seen there.

These facts may explain why infants do not thrive upon some milks, although the supply is abundant and the proportion of the different constituents, as shown by chemical analysis, is within normal limits.

The practical application of the above is, first, to recognize the necessity of supplying to nursing mothers a diet which is ample in all the vitamins. Vitamin A and vitamin C are the ones most likely to be lacking in the diet of poor. They are abundantly supplied by milk, eggs, green vegetables, and fruits, all of which unfortunately are expensive foods but should be included in the diet.

I have never seen and have never known of a case of scurvy in a child over two years old who was living under normal peace conditions. So far as vitamin A—so indispensable for the growth of children—is concerned, it is necessary only that care be taken that the diet include an ample supply, since it is not likely to be injured in the preparation or preservation of food.

We know well the dangers of vitamin deficiency when the diet is necessarily restricted because conditions do not admit of choice or variety of food. These conditions exist in times of famine, or great food shortage, or even may be the result of poverty, also in prisons, army camps, on shipboard, in Arctic regions and, one must add, in infancy. The consequences to children are serious, whether we consider simply arrested growth and general malnutrition or the diseases like scurvy and beriberi which result from marked and prolonged deficiencies. But it does not seem probable that except in conditions like those mentioned either children or adults who take the average or usual diet are likely to receive such small quantities of the vitamins as definitely to interfere either with growth or normal nutrition.

A glance over the list of foodstuffs known to contain the different vitamins shows how abundant vitamins are in most common foods. This may be one of the reasons why in the evolution of the diet of the human race certain foods have a place. It seems perfectly

evident that unless the diet given is a very one-sided one, children receive in their usual food a liberal supply of all these essential food constituents.

Two very striking things are brought out in the investigation of vitamins by the observation on animals: One is the very small amounts which are apparently required to produce their effects, and the other is the specificity of their action.

Until these substances have been isolated we shall not know the amounts required for normal nutrition. Apparently the amount of any one of them is not large.

Chick, Drummond and their associates at the Lister Institute have shown how much of different foods is required to protect laboratory animals against beriberi and also against scurvy, when the diet contained no other source of the vitamin in question. While this establishes much that is important with regard to the relative value of foods, it gives us no idea as to the actual amounts of vitamins required by human beings. All the evidence goes to show that the vitamin requirement is affected by many conditions. Laboratory animals in confinement may be expected to show effects of deficiencies in diet sooner than those living under natural conditions. It is well known that men who are much exposed and doing hard work are affected by scurvy sooner than others although all have the same diet. If the human diet is poor in other respects the effects of the absence of the antiscorbutic or any other vitamin is more quickly apparent.

How much of the different vitamins is needed for health we do not yet know. It is clearly not a definite amount for all human beings of the same age, sex and weight, but like our other food requirements the vitamin need no doubt varies with many conditions.

The great importance of vitamins for growth makes it imperative that the diet of children especially should contain the articles of food which are rich in these factors. The requirements of adults are for maintenance merely and undoubtedly are much less than those of children. This is especially true of vitamin A.

It is during the period of infancy that children are likely to suffer most; first, since infants are the most susceptible of human beings to all adverse conditions; secondly, infancy is the period of most rapid growth and anything which may affect growth produces its most marked effects at this time; and finally, the diet of infancy is necessarily a restricted one.

Proprietary foods are harmful, not so much from what they contain as from what they lack. They may be deficient in all three of the vitamins.

The specificity of action of these substances is quite as great as that of antitoxin in diphtheria or thyroid extract in cretinism. The different vitamins seem entirely independent of each other in their activity. They are in no way interchangeable; they seem to have no relation to one another. We cannot supply a deficiency in vitamin B by giving more of vitamin A, nor can we protect scurvy by the most liberal allowance of vitamin B. Each one has a perfectly definite function in nutrition, which, from all evidence now in our possession, can be performed by it but by nothing else.

If no vitamin deficiency exists in the diet it does not seem probable that general symptoms of malnutrition in children past the period of infancy who are taking a varied diet are due to a deficiency of any of these factors, nor that improvement in general nutrition is likely to follow their administration in larger amount, when no real deficiency exists. In other words, benefit from an excess of any of them seems most improbable and we lack proof that such is the case.

Another practical question is whether if the diet is low in its vitamin content, i. e., a condition of *relative* deficiency exists, there may occur perhaps not frank scurvy, beriberi, rickets or keratomalacia, but milder and less definite symptoms, such as failure to make normal progress in growth, malnutrition and general evidence of ill health. This is something difficult to establish. On *a priori* grounds it seems not improbable. It must be remembered, however, that symptoms such as those mentioned may be due to a great variety of causes other than vitamin deficiency. In the absence of definite means of diagnosis the only evidence of their dependence upon vitamin deficiency is the therapeutic test, viz. prompt and decided improvement which follows when foods known to be especially rich in the different vitamins are added to the diet—such as orange juice or yeast or cod liver oil. Reasoning from experience with deficiency diets in animals one would expect decided improvement in a few weeks. In this connection one is reminded of the patent medicine advertisement which ran somewhat as follows: "If you are cured you haven't got the disease. The remedy never fails."

It should first be evident from an analysis of the diet that a deficiency probably exists. The changes made should be as carefully planned as are laboratory experiments with rats or guinea-pigs

Otherwise the results reported to follow are likely to depend upon either the faith or the skepticism of the observer.

Some suggestive observations regarding the use of antiscorbutic vitamin have been made by Hess and others, in which the weight curve of infants showed a prompt rise on the addition of orange juice to the daily diet; but in many or most cases the diet was known to be, or at least strongly suspected to be, poor in this factor.

Vitamin B has been urged upon the profession in the form of yeast as being especially important for children who are not making the normal gain in weight, who suffer habitually from poor appetite and chronic constipation, etc. My own experience has been one of complete disappointment.

However, in view of the important part which we now know to be played by vitamins in nutrition, it behooves the physician in all cases of malnutrition, particularly when the explanation is not obvious, to investigate carefully the character of the food and its preparation to discover any errors which might result in a vitamin deficiency. Especially is this necessary in the case of chronic invalids or of delicate children whose diet has become greatly restricted from necessity or from caprice, and also in the case of infants, whose diet is always a restricted one. But until we have some more certain means of diagnosis than we now possess, the indiscriminate use of vitamins in other circumstances than the above for what is often referred to as "general results" is not likely to be beneficial; it should be discouraged. It is hardly scientific therapeutics.

It is most unfortunate that the popular interest in vitamins, which is the result of so much recent publicity as has been given to this whole subject, should be exploited commercially. Just now vitamins are in fashion and as much capital as possible is being made of this fact. The medical profession at all events should not be carried along in the popular current. Important and indispensable though vitamins are, one can fall into no greater error than to assume that vitamin deficiency is the chief cause of all chronic nutritive disorders; just as not very long ago these were all referred to auto-intoxication and at present a certain group would have us believe that they are due to some disturbance of the glands of internal secretion. The use of vitamins without definite indications will be popular for a period, but like other fads it will pass. With time and further investigation their true place will be determined.

Our knowledge of vitamins has taught the necessity of a variety of food and the danger which follows when conditions make a choice of variety impossible. It has taught us also the incomparable value of certain foods, particularly of milk, not only in infancy, but during the entire period of growth; also the importance in the diet of children of the green or leafy vegetables.

Our knowledge of vitamins has greatly helped to put the whole subject of nutrition upon a scientific basis. The experimental method has been substituted for the empirical one in determining the value of the different foods. Formerly we might know that certain foods were desirable or necessary; now we are able in very many cases to say why such is the case and to determine their precise value in nutrition. A knowledge of vitamins has furnished a key to many problems in nutrition which before were obscure or insoluble.

Until confirmed by clinical experience there is however some danger in relying too much upon the results of laboratory observations upon animals of a different species whose physiological needs may be different from those of human beings.

The study of vitamins has taught us several important things regarding the nutrition of children:

That children should eat a variety of food and that especial dangers may follow the habitual use of a very restricted diet.

That milk is the one indispensable food for children. The diet during the entire growth period should include if possible whole milk, or if skimmed milk is used, it should be supplemented by butter. Of the butter substitutes, those which contain beef fat, mutton fat and peanut oil are better than those in which other vegetable oils or lard are important constituents.

That a diet which includes no milk whatever should contain ample amounts of the green or leafy vegetables.

Cereals, particularly those from whole grains, and potato are important and adequate sources of the water-soluble vitamin B.

Fruits have other uses than as laxatives and as sources of mineral salts; they should form a regular part of the diet. When fresh fruits are not available dried fruits may be given, but they are distinctly inferior to canned tomatoes as sources of the antiscorbutic vitamin.

Cabbage is such a rich source of all the vitamins that it should

form a larger part of the diet than is usually the case, especially since it is cheap and in winter often almost the only green vegetable available.

In normal peace conditions the results of vitamin deficiency are most often seen in infancy. In rare cases they may be seen in older children and in adults, when there is extreme poverty, and still less frequently in those suffering from chronic disease or in very delicate children whose diet for a long period has been greatly restricted.

If the daily diet contains in reasonable amount unskimmed milk, cereals, potato, green vegetables and fruit, one need never fear a vitamin deficiency. While these articles are especially rich in vitamins, nearly all of our common foods contain them.

## Discussion of Above Papers.

Dr. Alfred F. Hess (New York City): This program has been very comprehensive. I have been most interested in that aspect of the subject dealing with rickets and I should like to say a few words on this topic. There has been a new era in the study of rickets in the past year. Previous to that there had been very few advances made since the work of Glissen in 1659. Very much more will be learned in the next few years by experimental work. We know now that there is an experimental animal which we can use for investigation; the disease can be produced in the rat. The disease can be regulated so that it can be cured or prevented by dietary means, although there is some limitation to the data which can be recognized by this animal experimentation. You have heard that the calcium-phosphate ratio is important. There can be either low calcium and normal phosphate, or there can be low phosphate and normal calcium; that is true as far as laboratory experiments are concerned, but it does not apply to a large number of cases which occur in the clinic, because even if we give a deficient amount of milk, we get the ratio the same. If the milk is diluted the phosphate and calcium ratio remains the same. That cannot be the chief factor, therefore, in the production of rickets. Rickets is a very common disorder of infants in the temperate zone. About 50 per cent. of breast-fed infants show more or less tendency to rickets in some form.

Here we must make a reservation:—we must state in which season an increase occurs, because the incidence of the disease is

more marked in the winter. It is at its height at the end of March; then it goes down again. There is something more than a seasonal incidence. If you follow the cases clinically by the X-ray, you will find that there is an increase in institutions month by month, during January, February and March. We have therefore to consider not only the seasonal, but the monthly incidence. I am connected with an institution in which excellent hygienic conditions are maintained, but we get this marked seasonal incidence of rickets.

In order to control the cases I had groups of infants examined and two thirds of them showed rickets in March, as evidenced by the X-ray. This may be due to absorption, and not due entirely to the food intake. You have heard to-day that light is also a factor in rickets, or rather the reciprocal reaction between food and light. There is a seasonal effect on the phosphate of the blood, as shown by the examination of the blood month by month. In the summer time there is a normal inorganic phosphate content of the blood, that is 4 to 5 milligrams per 100 cc. blood, but it is much lower than this in January, February and March. Thus there is a phosphate ebb and flow caused by lack of or increase of light. This has probably a direct relationship to the seasonal incidence of rickets. There is also a calcium wave, and this has particular influence on the seasonal incidence of tetany. Tetany occurs mostly in the spring.

Sunlight has a direct curative effect on rickets, but one can also use artificial light such as the mercury vapor lamp or the calcium arc light. Experiments in the laboratory showed that rats kept on a rickets diet could be prevented from having the disease by exposure to a carbon arc lamp, for three minutes a day, at a distance of three feet.

Another interesting fact in this connection is the well known one that colored infants are much more prone to rickets than white infants. This is also true in black rats, the melanotic form of the Norway rat, when given a rickets-producing diet in the laboratory. Even with exposure to the mercury arc lamp the black rats developed rickets, and the white rats under similar conditions did not acquire the disease. The pigment did not allow the light to pass to the tissues, and the pigmented skin of negro infants plays a part in their susceptibility to rickets. This factor of the reciprocal action of light and diet is a very wonderful thing and has broadened our conception of the pathology and the treatment of rickets. While the effect of light upon plants and animals has long been known, physiologists have been neglectful in the application of this principle to growing infants.

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